ELECTRICAL REVIEW

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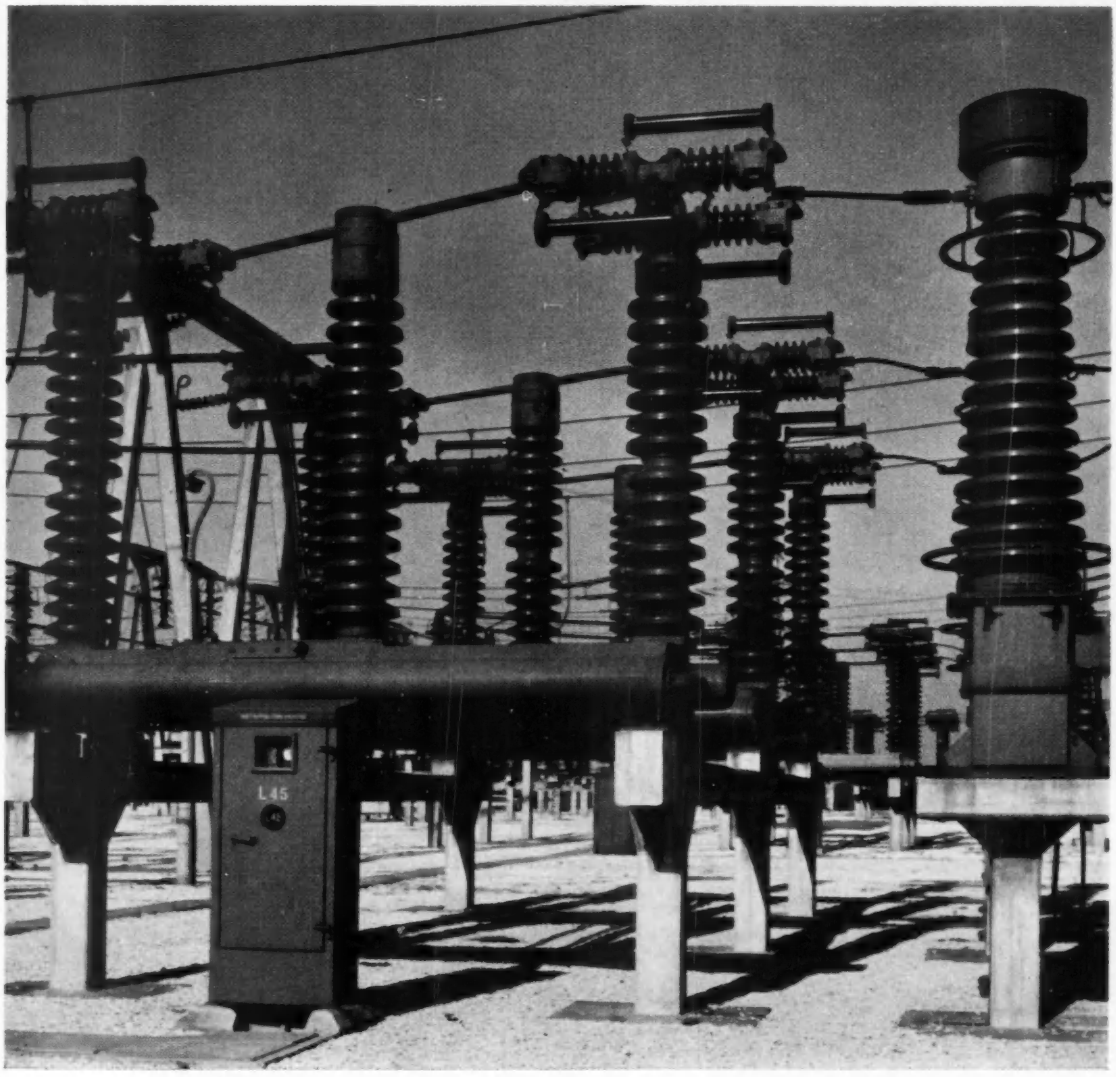

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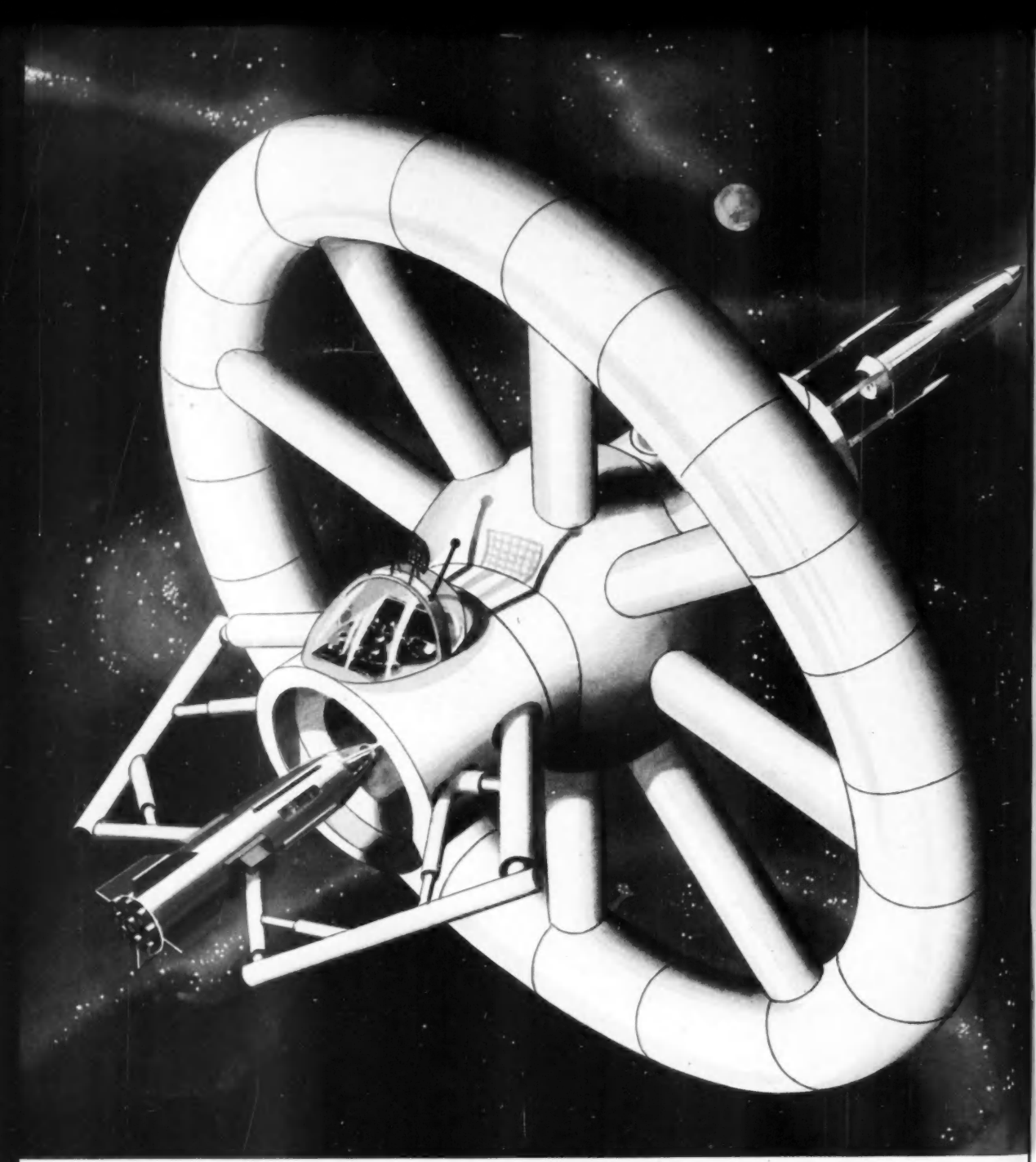

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ELECTRICAL REVIEW

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Export Attitudes

BRITISH manufacturers do not lack advice on how they could increase their exports and on the markets that demand their special attention. Delegations from abroad have told us how we should sell to their countries. A British trade fair was staged earlier this year in Portugal and in recent weeks there have been reports on the opportunities offered—and apparently being missed—by markets in the Middle East, Ghana and Scandinavia. Broadly, the common theme of these and previous reports and exhortations to greater efforts is that British industry has not shown sufficient enterprise in adapting its products and selling techniques to the more competitive conditions that now exist in overseas markets. Though exports have increased, Britain's share of world trade in electrical goods has declined.

Whether such general criticisms have had much effect on the large number of manufacturers who take no interest in exporting, or who consider exports only as a suitable outlet for surplus production, is difficult to discover. They must certainly irritate, and even discourage, those export managers who are working hard and with success to expand their sales abroad. The more direct and pragmatic approach to the problem of increasing exports to Western Germany has met with more obvious success. While the large expansion in the sales of British goods in Germany derives in part from the more favourable economic conditions, much of the credit is due to the trade drive initiated last year by the British Embassy in Bonn.

This has now been launched on its second phase by a visit here of prospective German purchasers of computers, and in an interview in the *Board of Trade Journal* Mr. Marjoribanks, H.M. Minister (Economic) in Bonn mentions that he has made a personal approach to some 500 British companies and that Britain will for the first time be officially represented at the important domestic appliance exhibition at Cologne next spring. Continuity is a significant element in the success of this drive. But ultimately, the substantial gains of individual manufacturers and industries this year are the most telling argument that there is now on the Continent a source of business that the British electrical industry can hardly afford to ignore.

World trade in electrical goods will go on rising, but for many products,

including domestic equipment, the greatest increases are likely to be in those markets, such as Western Europe and North America, which have not hitherto been regarded as traditional outlets for British exports. This does not mean neglecting the Commonwealth, which continues to take half our electrical exports, but it does suggest that greater attention must be given to markets that by comparison have been too readily dismissed as " small " and " difficult." If the industry's attitude towards export markets is to change, there is clearly much scope for co-operative effort in the fields of market research and publicity. Though the problems of an industry producing a single product are simpler, the success of the motor car manufacturers owes much to their having been forced to become " export minded " and to their having acquired the habit of looking to exports for a larger proportion of their sales than the electrical industry does.

THE NEW HORIZON

In accordance with custom, a theme has been chosen for next year's British Electrical Power Convention to be held at Bournemouth with Lord Chandos (chairman of Associated Electrical Industries, Ltd.) as president. The titles of the four papers which are to be presented are all prefaced by the term " The New Horizon " and as they will deal with electricity supply, electrical manufacture, electrical export and electricity in the home they will cover the main sections of the industry with the exception of the distributive side, which may, however, come into the domestic paper to some extent.

The rest of the programme contains the usual features—the presidential address, the annual dinner, the " Forum " and the annual general meeting. One great difference, of course, is the absence of the electrical exhibition which has formed an integral part of previous Conventions.

ELECTRIC STEEL MAKING

A most important decision has just been made by Steel, Peech & Tozer, Ltd., a branch of the United Steel Companies, Ltd. This decision is important not only for the company involved but also for the electrical industry as a whole since it involves the replacement of all the existing open hearth steel melting furnaces in the company's works by six electric arc furnaces. Although the economics of this sort of changeover have been well known in the steel industry for some years, mainly through the agency of the American Battelle Institute's report on the subject, this is the first British company to embark upon a major scheme of this nature; in fact, when the changeover has been completed, the Rotherham works will be the largest electric steel making plant in the world. The company is to be congratulated on its courage in going ahead with such an ambitious scheme.

From the electrical standpoint some idea of the magnitude of the plant can be gained from the fact that, when it is in full operation, it will consume about 750 million kWh per year, which is about six times the amount at present used by the whole works or more than a third of the existing industrial consumption in the Sheffield area. To provide the necessary power a new substation is to be built which will be directly connected to the 275 kV supergrid. This will be the first works substation to have an input at this high voltage. No doubt these developments at Rotherham will be closely watched by the rest of the British steel industry and we feel sure that, even before the work has been completed, other steel manufacturers will decide to go ahead with similar schemes.

THE " MECHANICALS " RATING CASE

Last year by a decision of the Lands Tribunal the Institution of Mechanical Engineers secured exemption from the payment of rates to the Westminster City Council under a clause in the Literary and Scientific Societies Act, 1843. Previously the Central London Local Valuation Court had assessed the Institution for rating purposes at £6,000 gross and £4,997 net.

In the Appeal Court last week the Tribunal's decision was reversed, making the Institution liable to the payment of rates. The grounds for the judgment were that the Institution was not formed for the purpose of science exclusively and as the members gained certain advantages from belonging to the Institution their subscriptions could not be regarded as " voluntary " within the meaning of the Act. Leave to appeal to the House of Lords was given. The case is of interest to many readers because of its possible effect upon other institutions.

PROGRESS IN REFRIGERATION

Remarkable advances in the provision of domestic refrigerators were reported by Mr. E. G. Rowledge, chairman of the Domestic Refrigeration Development Committee, last week. It is undoubtedly true that since the Committee's establishment in 1956 circumstances have been very favourable—purchase tax reduced and hire-purchase restrictions removed—but still the Committee can claim a great deal of credit for the progress made in the last two years or so.

There seems to be no reason why that progress should not continue, although it may seem rather sanguine to expect that sales will double in 1960, as they have done this year and as they did between 1956 and 1958. But when it is considered that only 16 per cent of the homes in Great Britain have refrigerators so far a little optimism is surely justified.

ECONOMY ON THE FARM

Electricity Boards are constantly expressing their disappointment at the small use farmers are making of the expensive rural lines put up for their benefit. And yet it has been clearly proved that it pays farmers to use electricity. Delivering the annual George Johnstone Lecture at Newton Abbot recently, Lord Netherthorpe, president of the National Farmers' Union, urged the greater use of electricity on the farm to meet the shortage of labour and rising costs. He quoted examples to show that, as compared with petrol operation milking, pumping costs could be about a third if electricity were used. Lord Netherthorpe went so far as to say that the future demand for electricity depended to a large extent on the level of agricultural activity, for farming was the country's largest single industry.

By
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and
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Electrical Controls in the Steel Industry—2

In this and the earlier article by the same authors (*Electrical Review*, 20th November) is described the approach of the electrical engineer to some of the many control problems of the steel industry. While the specific problems covered are but a few of the number which continually arise, it is indicated how much the electrical industry has done to bring the steel industry to its present high level of efficiency. In this second article particular attention is given to some of the more modern problems such as speed and tension control of the sheet during continuous cold rolling

A TYPICAL modern hot-strip mill layout is shown in Fig. 1. In this case there are four horizontal roughing stands and six finishing stands, which normally reduce slabs of approximately 3in thickness and 16in width to coiled sheet 0·064in thick. With narrower widths it will roll down to a thickness of 0·048in. On wider strip mills the control system is similar, but, of course, larger horsepowers are required.

Each stand is individually driven and the power and maximum speed of the drives vary from 700 to 1,750 h.p. and from 450 to 925 r.p.m.

Special problems arise owing to the fact that there is a variation in speed as the material enters and leaves the rolls of each stand. Since the material is simultaneously reduced in several stands it is necessary to control the stands to within close tolerances, otherwise small inaccuracies may be sufficient to produce interstand tension or stretching, with consequent deformation of the material. Similarly, loops must not be allowed to form lest they build up, fall over and cause a double thickness entry which would damage the mill rolls and cause the material following to pile up. Good rolling is obtained without tension. Unlike a cold mill which accelerates with the material in the mill from almost zero speed, a hot continuous mill is run at a fixed speed, and entry is with the stands running at this speed. Thus, there has to be good control of stand speed and interstand looping, and a quick recovery after the initial impact drop. The setting-up procedure for the mill must be simple and flexible, so that rolling programmes may be changed quickly, simply and confidently. Furthermore, during rolling itself the stands should be capable of being adjusted to trim the speeds for any variation in slab temperature and stretch in the mill housings.

The control of the roughing stands is straightforward since the strip is travelling slowly, and the piece leaves one stand before entering the next. Since stands R3 and R4 are close together, R4 is a d.c. drive which can vary in speed to match the speed of R3, which only varies according to the roll diameter, since it is a constant-speed machine. The speed of R4 can also vary according to the draft taken on R4, so that the ability to adjust its speed gives greater flexibility in rolling.

For the finishing train, however, higher rolling speeds require additional control, and two systems are used:—

(a) Grid-controlled mercury-arc rectifiers connected in parallel banks supply the main bus system for the motor armatures; this voltage is adjustable over the range 360/600 V and is held constant to changes in load or supply voltage by a magnetic amplifier control on the grids of the rectifiers.

(b) Speed control of the individual motors is applied through the mill motor fields in order to obtain both accuracy (of ¼ per cent) and a fast transient response.

The rectifier voltage control is shown diagrammatically in Fig. 2. This consists of a magnetic amplifier which feeds the control grids of the mercury-arc rectifiers. The reference winding of the magnetic amplifier is fed from the reference rheostats, which determine the output

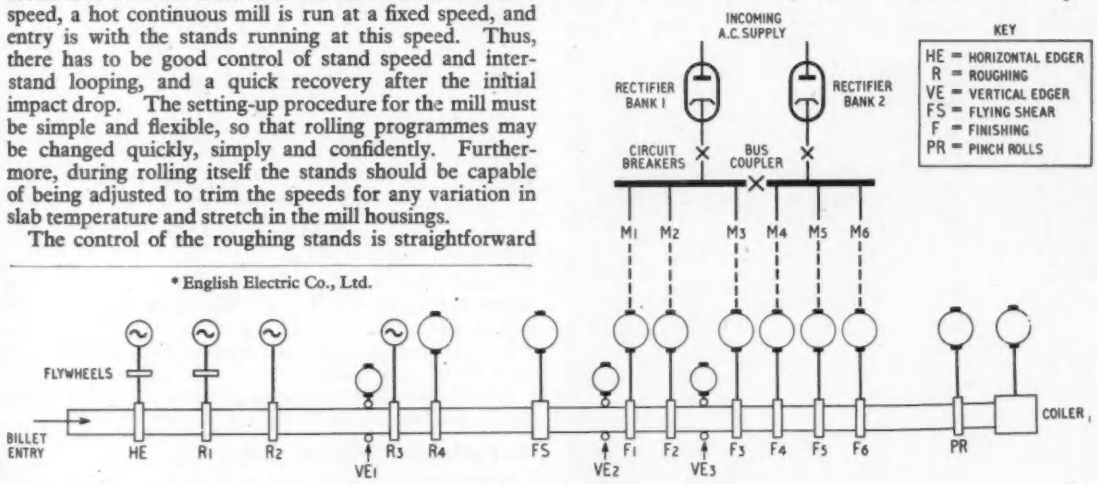


Fig. 1.—Typical modern hot-strip mill electrical layout

* English Electric Co., Ltd.

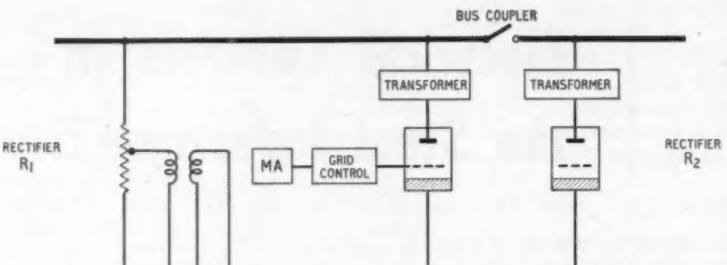


Fig. 2.—Rectifier voltage control as applied to hot strip rolling

voltage of the rectifiers. A signal proportional to this output is backed off against the reference, and the difference between these two provides the correct excitation for the selected output. In this way the voltage is set, and so long as the reference is not changed the output voltage will be held constant. When a load is applied the voltage will tend to drop, and the increased error will increase the output of the magnetic amplifier until a balance is again reached. The range of voltage is from 360 to 600 with any of the three bus arrangements previously mentioned.

In a similar manner a closed-loop speed control operates on each motor to maintain its speed constant at the pre-set value, which can be adjusted by the mill operator. To help to set up the mill and to maintain the correct rolling condition, automatic loop lifters, which can be seen in Fig. 3, are included. The loop lifter arm, which is held in contact with the strip, drives the arm of a position rheostat, and any difference in speed between adjacent stands causes either a slow increase or decrease in the length of the strip. This causes the looper arm to move, displacing the position rheostat, and this error signal is amplified through a magnetic amplifier which trims the speed of the preceding stand. A master stand is chosen and adjustment is made both forwards and backwards from this.

Fig. 3.—Stand of hot-strip rolling line showing loop lifters which control the arm of a position rheostat

Rod and Bar Mills

With this type of mill looping and stretching are very much more important, owing to the smaller sections being rolled and the greater accuracy required in the finished product. However, using a combination of motor field control and compounding (i.e. a signal which reduces the speed according to the armature current), the areas of loop and stretch can be kept within permissible limits.

The accuracy required for a drive of this kind (operating up to 6,000 f.p.m.) is obtained by applying an automatic speed control through each motor field by means of laminated frame control exciters in series with each field. The basic speed control circuit is shown in Fig. 4.

The voltage from the pilot exciter (which is proportional to the motor speed) is backed off against a set speed reference voltage. The difference is then amplified through a magnetic amplifier on to the field of the series exciter, which bucks or boosts the field voltage in such a way as to correct, via the motor field current and hence the speed, for any variations. Under steady conditions the pilot exciter voltage equals the reference voltage and the field exciter gives no output, but, under transient loading conditions, i.e. when metal enters the rolls, the speed of the motor tends to fall. Thus, the reduced pilot exciter voltage causes a current to flow in the magnetic amplifier control winding, which makes the series exciter buck the field supply voltage, thus reducing the field current and letting the motor return to its former speed.

On certain mills of this type the material, instead of being coiled up or reeled, is cut into straight lengths. The stock is run out of one of the intermediate stands at rolling speed and cut into lengths by flying shears placed just beyond the chosen stand. The material is therefore cut while travelling at speeds of up to 2,300 f.p.m., necessitating high-speed, high-accuracy automatic control.

The shear consists of two blades, geared together and driven by a 75 h.p., 230 V standard mill-type motor. The blades are accelerated to the cutting speed and shear the bar and are then decelerated and brought to rest for the next operation. The permissible time is 0·3 sec to accelerate to 2,300 f.p.m. blade speed; this is known as stop-start operation.

Thus, a low inertia drive is obviously necessary, and yet since the shears will be cutting over a wide range of speeds down to about 900 f.p.m. on heavier sections, enough inertia has to be built into the drive to effectively carry out the heavy low-speed cut. On the control scheme a combination of magnetic amplifiers and quick-acting control exciters is used to achieve this performance.

Single Stand Cold Strip Mills

While hot-strip mills may be used to roll steel down to less than 0·05in thick, most steel products below this

thickness are cold rolled to obtain the benefits of improved surface, temper and accuracy of gauge. The cold rolling usually takes place in a reversing single-stand mill in which the strip is passed back and forth between the rolls, which are brought closer together on successive passes. The rolls are normally driven by a motor having simple Ward-Leonard control, with an additional speed range by shunt-field control. This shunt-field range allows the maximum torque needed on the earlier passes where high speed is less essential, but gives the higher speeds on the final passes when the coil of strip has become much longer.

The control of the coiler drive is, however, far more exacting. The strip passes between reels which alternately pay out and coil up the strip under tension. The tension serves a dual purpose: first, a tight coil is self-supporting and, secondly, the tension helps to pull the strip straight in rolling. In this way it enables heavier reductions to be made, and gives a flatter and straighter strip.

The accuracy of tension control needed varies with the type of mill and the product being rolled. In some cases the tension must be fairly near to the yield point of the material, and needs accurate control to provide sufficient stress without the excess which would cause strip breakage. In other cases tension sufficient only to prevent a slack coil is needed.

A typical single-stand cold-strip mill is shown in Fig. 5. This is a reversing mill with a top speed of 1,500 f.p.m. The mill rolls are driven through gearing by a 240 h.p. d.c. motor with a shunt range of 286 to 955 r.p.m. The coilers on each side of the mill are designed for coils of up to 51in diameter on an 18in mandrel. The coiler motors are rated at 130 h.p. over a speed range of 280/775 r.p.m.

The control scheme is indicated briefly in Fig. 6. The mill motor (MM) is supplied by its own Ward-Leonard generator (MG) the field of which is controlled by the motorised rheostat in series, which is graded to give uniform acceleration of the mill. Contactors enable the generator field to be reversed to give either direction of rolling. The motor field is pre-set by a separate motorised rheostat to give the required maximum torque or speed for the particular reduction.

The coiler control is designed to give accurately the tension set by the operator under all speeds of rolling and during the acceleration and deceleration at either end

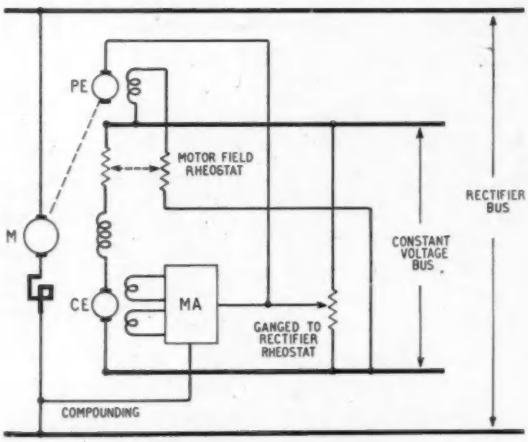


Fig. 4.—Basic speed control circuit for bar mill

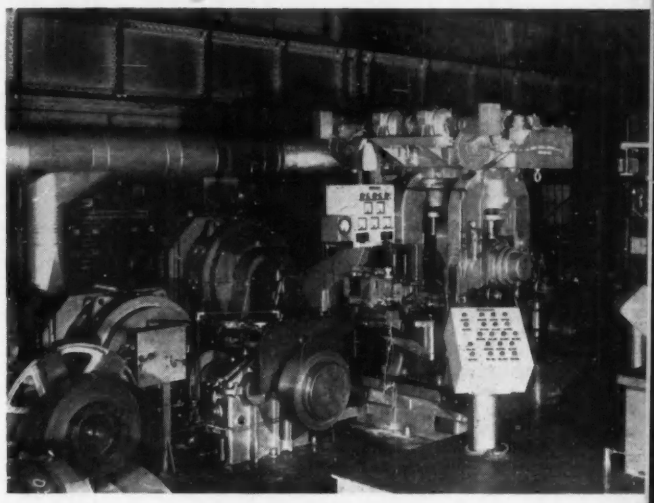


Fig. 5.—Typical single-stand cold-strip mill

of the coil. To obtain the necessary accuracy the control is divided into two functions:—(a) The motor field strength is maintained proportional to coil diameter; (b) the motor armature current is controlled to give the required tension.

For (a) it can be shown that if the back e.m.f. of the coiler motor varies as the strip speed, the motor field strength must vary with the coil diameter. The strip speed is measured by the pilot exciter (PE) coupled to the mill motor. The e.m.f. of this exciter is compared with the back e.m.f. of the coiler motor (CM), and any difference is applied to the control winding of a magnetic amplifier (MA). The amplifier output supplies a field on the coiler motor so that any difference in motor and pilot exciter e.m.f. is corrected by a change in the amplifier output. Providing the e.m.f. difference is small, the motor e.m.f. is proportional to strip speed, and the tension will be proportional to armature current.

As the coil diameter increases during the coiling operation so the motor flux must rise. While the magnetic amplifier can be designed to supply all the field current, more accurate control results from the use of a follow-on rheostat to limit the output required of the amplifier. The main field of the coiler motor is supplied from the constant-voltage exciter through a series rheostat (FOR). The rheostat is driven by a pilot motor (PM) which is connected across the output of the magnetic amplifier (MA). As the amplifier output rises the pilot motor drives the rheostat, so limiting the control range needed from the amplifier. The follow-on rheostat movement corresponds with coil build-up, and its position provides an indication of coil diameter at any instant.

For (b) the current control acts through the coiler generator to give an accurate fast response. In order to maintain the armature current proportional to the required tension, two exciters are arranged so that any difference in their voltages is applied to the field of the coiler generator. The reference exciter (RE) is arranged so that its voltage, controlled by a hand-set field rheostat, is proportional to the required tension. The current exciter (CE) has its field winding connected in series with the coiler motor armature, so giving an exciter voltage proportional to the motor current. Any difference

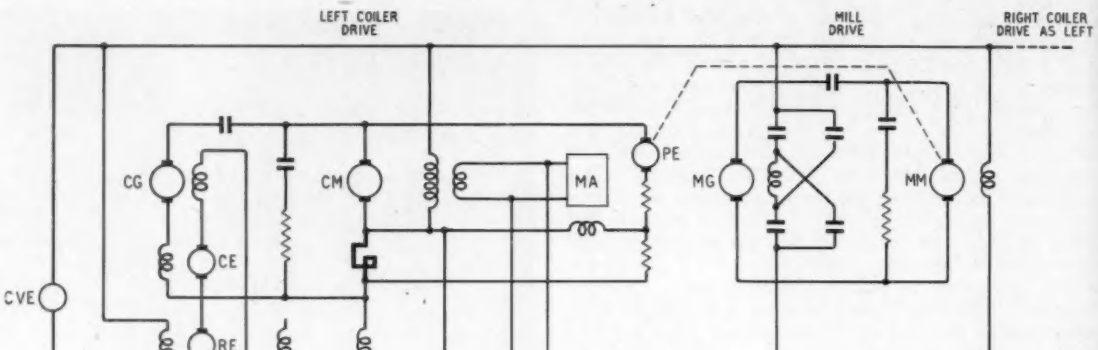


Fig. 6.—Basic control scheme for single-stand cold reversing mill

between the exciter voltages represents an error between the actual and intended motor armature current, but as this difference is applied to the low-resistance field winding of the coiler generator a strong corrective voltage is developed which holds the current error down to a very small value.

The loss field takes a signal of speed from the pilot exciter and the acceleration field from an exciter giving an output proportional to the acceleration rate. Both the effects are variable with coil diameter and the follow-on rheostat provides a ready means of modulation with changing coil diameter.

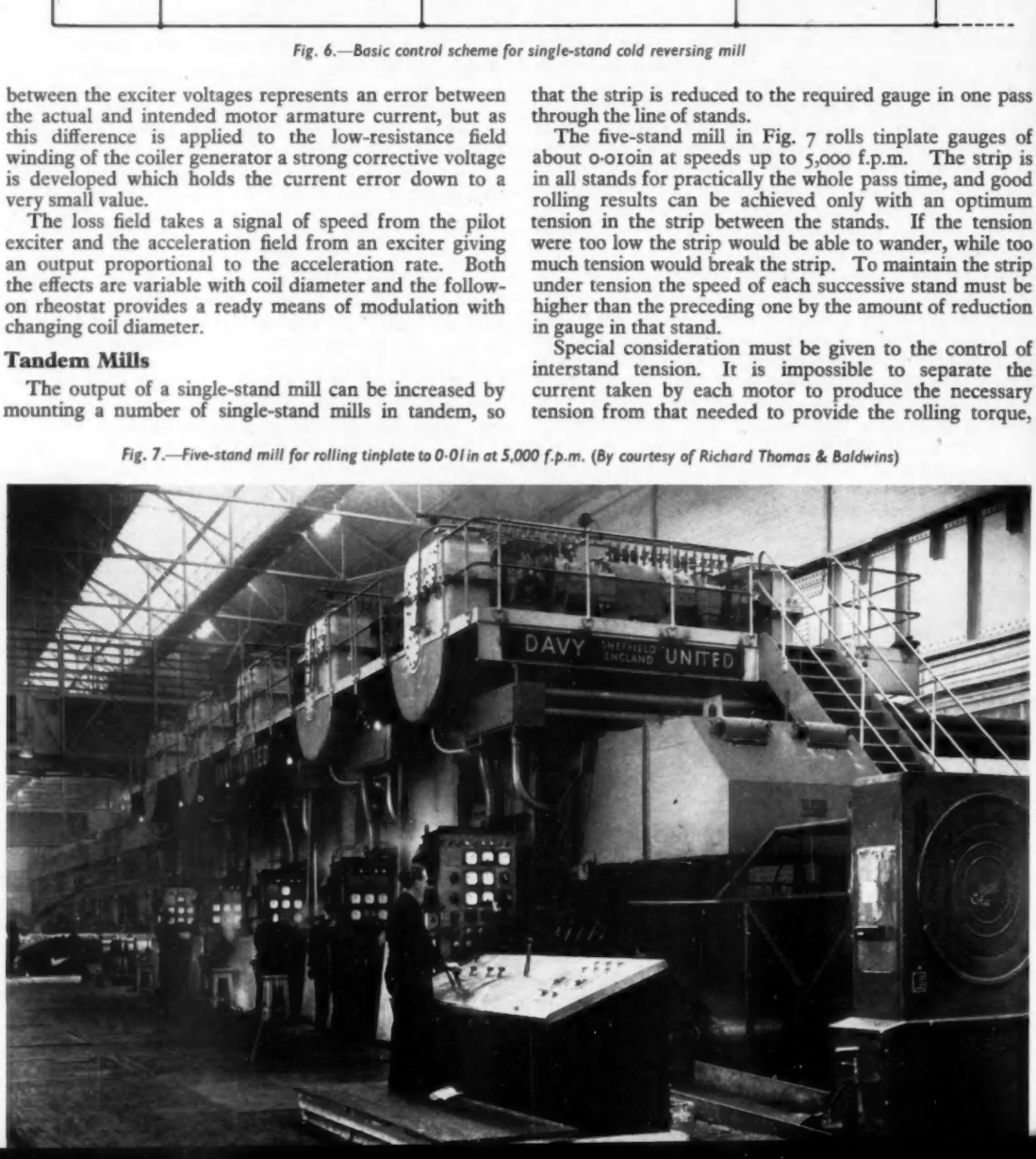
Tandem Mills

The output of a single-stand mill can be increased by mounting a number of single-stand mills in tandem, so that the strip is reduced to the required gauge in one pass through the line of stands.

The five-stand mill in Fig. 7 rolls tinplate gauges of about 0·010in at speeds up to 5,000 f.p.m. The strip is in all stands for practically the whole pass time, and good rolling results can be achieved only with an optimum tension in the strip between the stands. If the tension were too low the strip would be able to wander, while too much tension would break the strip. To maintain the strip under tension the speed of each successive stand must be higher than the preceding one by the amount of reduction in gauge in that stand.

Special consideration must be given to the control of interstand tension. It is impossible to separate the current taken by each motor to produce the necessary tension from that needed to provide the rolling torque,

Fig. 7.—Five-stand mill for rolling tinplate to 0·01in at 5,000 f.p.m. (By courtesy of Richard Thomas & Baldwins)



and so a current-control system similar to that for a single-stand mill coiler cannot be used. That system is, of course, equally suitable for the coiler on a tandem mill. Interstand tension is produced on a tandem mill by arranging that the motors have a suitable regulation, and adjusting their relative speeds by shunt-field control.

The speeds are first set on no load to correspond with the reduction to be taken in each stand and are then adjusted so that the first stands attempt to go more slowly and the later stands faster than the actual strip. As the stand coupling through the strip prevents this attempted change of speed from taking place, a change of load takes place in each motor to produce a tension which is dependent both on the regulation of the motor and the attempted change of relative speed.

Once set up the tension may be adjusted by the alteration of the shunt field of the motor; for example, if the field of stand 3 motor is weakened the motor would attempt to go faster and would result in a reduction of tension between stands 3 and 4, with an increase of tension between stands 2 and 3. The earlier tandem mills were supplied from parallel Ward-Leonard generators, similar to the hot continuous mills, in place of rectifiers. However, the wide ratio between threading and running speeds on modern cold tandem mills results in such a system having poor regulation at thread speed. With higher speeds the combined motor power required could only be provided by six to eight generators which, when in parallel, give problems of control and protection. It is therefore quite natural for the larger high-speed tandem mills to have individual generators with some form of closed-loop speed or voltage control.

The basic control circuits for one stand of a five-stand tandem mill are shown in Fig. 8, this stand having a two-armature drive. The motor fields are supplied in series from an exciter (ME) which has a shunt field energised through the stand speed setting rheostat controlled by the mill operator. The exciter also has a differential series winding which both increases the speed response of the main motor field and reduces any changes due to main motor field temperature variation.

A speed reference busbar is common to all the stands. This is supplied from the exciter (RBE) on the left of the diagram, which is energised through a motorised potentiometer the control of which governs the acceleration and deceleration of the whole mill.

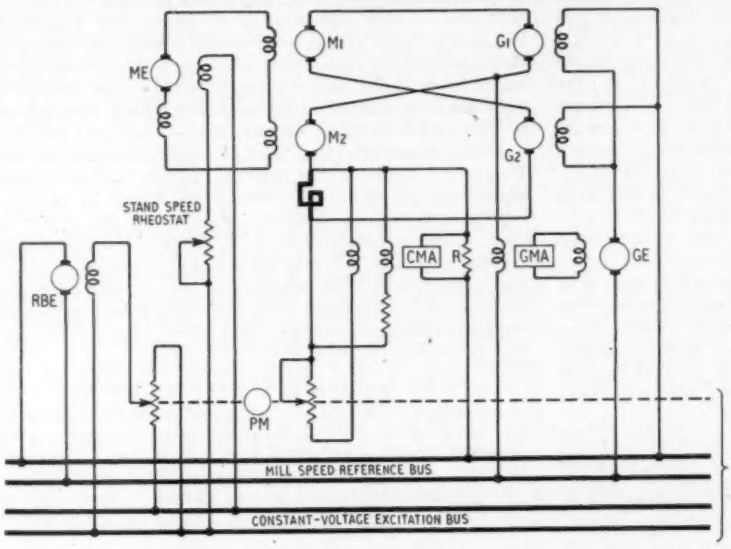
The voltage across the motor armature is compared with the reference busbar through the control winding of a push-pull magnetic amplifier (GMA) which, in turn, excites the field of the generator exciter (GE) supplying the parallel-connected fields of the two generators (G1 and G2). This system provides a closed-loop control of motor terminal voltage, maintaining it at a value equal, but for the small controlling error, to the reference busbar voltage. With such a system the stand voltages are matched, but the regulation due to IR drop remains.

The regulation is controlled by introducing a voltage into the GMA control circuit from the compounding magnetic amplifiers (CMA) by means of the loading resistance (R). A control winding of CMA is connected across the compoles of one of the motors and so carries a current proportional to the armature current of the motor. The output of CMA and voltage across R are therefore proportional to the motor IR drop. By making the voltage across R equal to the motor armature IR drop and opposing the motor terminal voltage the control winding of CMA would compare the motor e.m.f. with the reference busbar. Such a system has no regulation and would not be practicable as the smallest error in field setting on one stand would cause an excessive change in tension between that and adjacent stands.

Some regulation must be left in the system, and this can be arranged in two ways. First, an extra winding on CMA is excited, also from the motor compoles, but in opposition to the first. This second winding has a rheostat in series which is coupled to the reference busbar exciter field potentiometer and graded so that its current is also proportional to the reference busbar voltage. The second winding causes a drop in speed of the mill which is proportional to actual speed as well as load, and therefore tends to maintain constant interstand tension over the whole Ward-Leonard range.

Secondly, regulation can be introduced by reducing the effect of the first winding to, say, 80 or 90 per cent IR compensation. Unlike the first system this gives increasing regulation as the speed of the mills falls, though the magnitude is much less than the natural IR drop effect. For rather complex reasons an increased regulation is desirable at thread speed on high-speed tinplate mills, for which the second system is more suitable. In practice, operating conditions determine whether either or both systems of regulation are introduced.

Fig. 8.—Basic control circuit for one stand of a five-stand tandem cold strip mill



Processing Lines

While a number of the products of the steel industry can be used in the form in which they leave the mill, a considerable proportion is processed in some way both between rolling operations and after completion of reduction to the finished gauges.

The processing may take the form of pickling, electro-

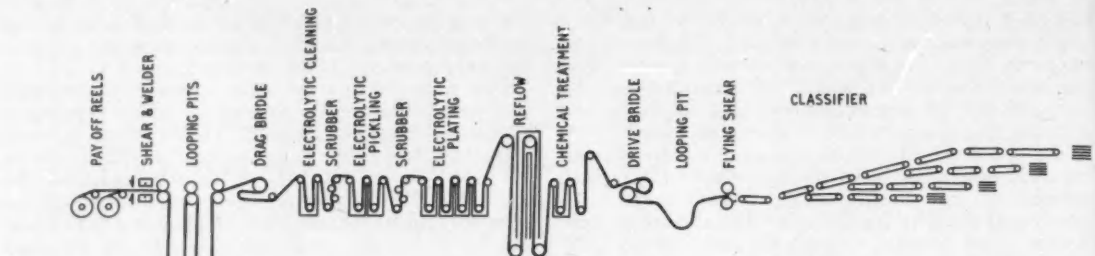


Fig. 9.—Production flow line through electrolytic tinning section

lytic cleaning, tinning or galvanising, annealing, side trimming, slitting and shearing.

Originally these processes were carried out slowly in simple continuous lines or by individual handling of sheets. As the production capacity of the mills increased, continuous high-speed processing lines were developed to handle this greater output. At present, speeds of up to 4,000 f.p.m. are being used on tinplate side-trimming lines.

While it is impossible to generalise on the control of processing lines the methods may be placed under broad headings:—(a) Speed controls, (b) tension controls, (c) position controls, (d) d.c. current control for electrolytic processes and (e) a.c. voltage control for strip heating.

Fig. 9 shows a section through a tinning line with the controls for the various drives and power supplies classified as above. The line operates at about 1,000 f.p.m. and converts coils of steel cold-rolled to about 0·01in thick into sheets of tinplate having a uniform layer of bright tin about 0·00006in thick.

ELECTRIC STEELMAKING

ALL the existing open hearth steel melting furnaces at the works of Steel, Peech & Tozer, Ltd., are to be replaced by six electric arc furnaces of 110 tons capacity each. When this £10 million changeover is completed in about five years' time, this will be the largest electric steelmaking plant in the world with an annual capacity of 1,350,000 ingot tons of steel. It is also the largest single development scheme in the eighty-year history of this branch of the United Steel Companies, Ltd.

At the present time, there are twenty-one open hearth furnaces at Steel, Peech & Tozer—fourteen in the Templeborough melting shop and seven in the Rotherham melting shop—producing about one million ingot tons of steel per year. The existing Templeborough melting shop is to be adapted to house the new electric furnaces. This will mean the disappearance of a well-known local landmark with the demolition of the fourteen 120ft high chimneys for waste gases. The Rotherham melting shop will be demolished entirely.

Initially, four electric furnaces of the swing-roof type will be installed, and it is planned to have the first of these in commission by January, 1963. Arrangements have been made to maintain the existing level of steel production during the changeover by fitting double oil burners to some of the furnaces and converting others to "all-basic" refractory linings.

No order has yet been placed for the supply of the electric furnaces, but almost everything apart from the electrical equipment is to be manufactured by the Distington Engineering Co., Ltd., a United Steel subsidiary.

Negotiations with the electricity supply authority for the supply of power have not yet been concluded but the power requirements of the new plant will be 750 million kWh per year—six times the amount used by the whole works at present, and over one-third of the existing industrial consumption in the Sheffield area. A new electrical substation is to be built near to the company's Brinsworth mill which will take power at 275 kV from the supergrid. This substation will house the Yorkshire Electricity Board's transformers and switchgear and will permit a metered supply of power at 33 kV to be conveyed by cable to the Templeborough melting shop, where it will be transformed down to a working voltage of 565/200 V for furnace consumption.

The changeover from the open hearth to the electric arc process will entail the provision of new steam generating equipment as all the existing waste heat boilers will become redundant. Special attention will be given to fume extraction equipment with the aim of minimising the dust nuisance.[1] A new ingot mould preparation building is to be laid down adjacent to the melting shop and this will be twice the size of the existing mould preparation building, which it will replace.

Royal Institution Christmas Lectures

A course of six lectures for juveniles will be given by Dr. T. E. Allibone, F.R.S., at the Royal Institution, 21, Albemarle Street, London, W.1, on 29th and 31st December and 2nd, 5th, 7th and 9th January. The subject will be "The Release and Use of Atomic Energy." The subscription will be £1 for juveniles (aged 10-17), and £2 for adults (non-members).

VIEWS on the NEWS

By REFLECTOR

IT is a sign of the times that more and more people are coming to prefer electric heating to the "cheerful" (but troublesome) coal fire, even when they are offered something for nothing. In Battersea, London, where a smokeless zone has been created, householders are being offered new coal grates for the burning of smokeless fuel. The Borough Council, however, is surprised at the number of people who are not availing themselves of the offer although the Council is willing to pay £7 of the £8 which the grates cost. The *South London Press* reported recently some remarks on the subject by a Council official. He said that most of the people concerned are out all day and used electric (or gas) fires at night and week-ends. Although the circumstances may be regarded as special they are certainly not unusual and it confirms me in my opinion that it would pay the National Coal Board to encourage the use of coal-produced electricity (or even gas) rather than smokeless fuels.

* * *

Rather fancifully, Richard Fitter, writing in the *Observer* recently, said that "already nuclear power stations pepper our wilder shores." The five or six stations now being erected are peppering the shores rather thinly, but perhaps Mr. Fitter was anticipating. His immediate subject was the handicap to the study of coastal erosion represented by the decision to site a nuclear station at Dungeness, Kent.

> "As a result (he says), in thirty years' time an unapproachable radio-active hulk will stand on Dungeness, while villages in East Anglia may still be falling into the sea for lack of the knowledge that only the Dungeness shingle could have provided."

This seems to be putting the matter rather strongly but it points to another "headache" for the much-harassed C.E.G.B. Mr. Fitter, however, does pay the Board the compliment that it "appears genuinely anxious to help to minimise the inevitable damage to wild life at Dungeness."

* * *

A short time ago a lady wrote to the Brighton *Evening Argus* calling attention to what she considered a "possible note of danger" in one of the pictorial plaques which have been put up in the town as part of the Christmas decorations. The reference was to a "Polly Put the Kettle on" plaque showing a little girl holding an electric kettle "complete with dangling flex and plug." The writer said that a child could imitate this in her home with disastrous results. Contrarily, I see little danger in this. To have a dangling flex and plug is surely better than having a connector dangling from a connected plug, which is too common a practice. Anyway, the local traders' association, which apparently is responsible, said that the artist could not have appreciated the "psychological danger" (beautiful phrase!) of the picture and they promised to try to have the offending flex erased. Still, the incident does show a public awareness of the need for handling appliances sensibly.

* * *

During the past few years the cooling system of the Tir John (Swansea) power station has been almost mussel-bound on occasions and extraordinary steps have had to be taken to deal with what has become a regular pest. The story is told at length in the November issue of *Dragonpower* (the magazine of the South Wales Division of the Central Electricity Generating Board). Millions of mussels have been blocking the ends of the condenser tubes. In 1956 and 1957 chlorination of the inlet cooling water was resorted to with some success but later it was apparent that the problem was again becoming acute. Massive steel doors, weighing three tons each, were lowered over the inlets in the King's Dock and the water was pumped to a low level. It was discovered that the upper surfaces of the Dock end of the system were covered with from 4 to 6 inches of mussels; the cleaning of a 70ft long section produced 50 tons. Work on the elimination of these persistent and prolific shellfish has since proceeded and the article ends on a fairly optimistic note.

* * *

An envelope received from one of the Central Electricity Generating Board's regions bears the injunction:—"Sleep with an Electric Blanket." That is reasonable so far as it goes, but it is a pity that the limitations of the postal franking machine precluded the addition of the words—"switched off." Both from the safety and comfort aspects I do not think it desirable to sleep with the blanket running.

* * *

Seventy years ago, it seems, British manufacturers were hesitant to adopt the new-fangled electric motor for the *Electrical Review* of 13th December, 1889, was impelled to say:—

> "Now that electric motors have become a commercial article, and are practically reliable, it is certainly rather strange that in this country, at least, these machines have not come into greater favour than is at present the case, more especially as they could be advantageously employed in many branches of trade. This is all the more surprising when the great developments in the other branches of electrical engineering are taken into consideration, thus leaving, as it were, electric motors almost entirely out in the cold. If a correct and thoroughly reliable return were made of the number of electric motors in use in the United Kingdom it would doubtless be found that there are scarcely more than fifty at present employed, if, indeed, the figure is so high."

Meter Operation in the Tropics

By C. H. MELLOR, M.I.E.E.*

THE ability of meters to retain their accuracy over lengthy periods depends upon a number of factors, one of which is the conditions under which they are installed. In Rangoon, meters are called upon to operate in temperatures and humidities in excess of 90°F and 90 per cent. The results of a survey of meters installed under such conditions are not without interest.

The purpose of the survey was to provide information upon two specific problems. First, the length of time meters can be permitted to remain in service without developing major errors; and second, whether the present policy of standardising a minimum capacity of 5 A for meters is desirable.

The Rangoon generating plant was destroyed during the war and electricity supplies were not generally available to private consumers until 1951. There are very few meters on the system which were installed earlier than 1951.

Rangoon has now 60,000 consumers of which 56,000 can be classified as small domestic and commercial consumers whose individual consumption is less than 25,000 kWh per annum. Of these it is estimated that 40,000 consume less than 250 kWh per annum. Small industrial or domestic "power" installations are excluded, as they are chargeable under separate tariffs, and the utilisation is therefore restricted to lighting, fans and radios.

No Special Selection

The meters surveyed were not selected and the tests taken were the usual incoming tests to which all meters disconnected from the system for routine reasons (disconnections, changes in tenancy, changes in position or size) are subjected upon return to the meter store. Meters were transported from site to store under normal arrangements. The meter store is situated at the laboratory.

The number of meters surveyed was 100 and they were all 5 A, single-phase instruments. Altogether, 60 of these meters had been in service between five and six years, 21 between six and seven years and the remainder over seven years. Three had been in service over 10 years. All the meters were of British manufacture and 97 were the product of one firm; 77 were purchased in 1951 or later and are of current design.

From examination of the results it can be seen that 90 were within the limits of accuracy (±2 per cent) at full load. Only three of the "faulty" meters were of current design and all had been in service for seven years or over and were purchased before the war. All "faulty" meters tended to run fast and it is thought that the principal cause was weakening of the magnet.

At 5 per cent load, 76 of the meters were found to be within the prescribed limits of accuracy. In this case the tendency was to run slow, probably due to increased friction. A third of the "faulty" meters had been in service for over eight years or were of non-current design. Of the 23 meters purchased before 1951, 12 were found to be faulty at one or other of the loads, and the remainder were approaching the limit of accuracy.

TEST RESULTS FOR 100 METERS

	Error	Full Load	5 % Load
PER CENT SLOW	Inoperative	—	6
	Above 5%	—	1
	4%–5%	—	1
	3%–4%	—	4
	2%–3%	—	7
	1·5%–2%	1	17
	1%–1·5%	—	7
	0·5%–1%	4	13
	Below 0·5%	11	8
	Correct	5	6
PER CENT FAST	Below 0·5%	18	3
	0·5%–1%	20	8
	1%–1·5%	16	7
	1·5%–2%	15	7
	2%–3%	7	4
	3%–4%	3	—
	4%–5%	—	1
	Above 5%	—	—
	TOTAL	100	100

In general, it is considered that the survey showed that the condition of meters remains satisfactory, subject to a good quality of meter being used, up to a limit of seven years in service. Although six meters were inoperative at 5 per cent load, reference to the meter cards showed that all had been installed on medium-size installations and there was no evidence that they were inoperative while actually in service. It is therefore considered that further evidence will have to be obtained before a departure from the present standardisation policy is made.

It is now proposed to take similar surveys on meters, returned through routine changes, as a standard practice. In the course of time, information can then be obtained concerning meters with a longer installation life and of other than British origin.

The latter is a matter of considerable importance. Meters are offered by Continental and Japanese makers at prices which are a half or a third of the U.K. price. Such meters pass routine calibration tests, but it remains to be seen how they retain their accuracy in service.

* Chief Engineer, Rangoon Electric Supply Board.

Technological Training

THE number of students in technical colleges taking courses leading to the Diploma in Technology is now nearly twice the total a year ago—3,320 as compared with 1,786. This was stated by Mr. A. A. Part, Under-Secretary in charge of Further Education at the Ministry of Education, when speaking to industrialists at a lunch-time conference at the Bradford Institute of Technology on 3rd November. The National Council for Technological Awards, which provided the figures, had also approved twenty-nine new courses in the year, bringing the total number up to eighty-four. Over 1,400 of the students are in their first year.

Mr. Part said that the figures also showed that the Colleges of Advanced Technology, of which Bradford is one, were advancing rapidly. They accounted for three-quarters of all Dip.Tech. students. The total number of advanced students in these colleges taking full-time and sandwich courses of all kinds had increased from about 4,500 in 1955-56 to over 7,100 in 1958-59. The plans so far approved for these colleges should enable this total to be increased to about 12,000.

New Books

Magnetic Sound Recording. By D. A. Snel. Pp. 230; figs. Published by Philips' Technical Library and distributed by Cleaver-Hume Press, Ltd., 31, Wright's Lane, Kensington, London, W.8. Price 25s.

The present wide interest in magnetic sound recording is due to the development of recording on tape and this aspect of the subject is dealt with almost exclusively in this book. In the design of a tape recorder diverse problems ranging from mechanical to electronic have to be solved and whilst some solutions are obvious extensions of existing techniques, others need some degree of original approach. The book describes the problems involved and the methods which have been evolved to overcome them and also goes into some matters having a fundamental bearing on the subject.

An immensely wide range is covered by this publication in its 23 chapters. After a brief introduction there are chapters on sound and magnetism before dealing with the general theory of the process of recording on tape. A curious intrusion here is a description of the Philips-Miller system which makes no use of magnetism. Drives, heads and the tape itself are then dealt with, followed by amplifiers, loudspeakers and microphones. This occupies a little over half the text, the second part of which is taken up mainly with the application aspect of the tape recorder. Practical recording, hints on playback, stereophony and sound for sub-standard films are amongst the subjects covered and there is an exhaustive list of possible uses to which a tape recorder may be put. Amongst sundry matters such points as the connection of recorders to radio receivers and the improvement of room acoustics receive attention.

With so wide a scope it is inevitable that the treatment is somewhat superficial, but the book serves a useful purpose in providing a comprehensive general view of the subject suitable for the technically-minded amateur.

There are too many mistakes and misprints. A particularly bad example is the statement on p. 12 regarding speed variations of 10 per cent which is certainly intended to be a much smaller figure and when the matter is again raised on p. 64 a further misprint occurs which still leaves the reader in uncertainty. The book is a translation which may account for certain passages where the meaning is not completely clear and others where a definitely wrong meaning emerges. These points are not likely to mislead seriously, but they may puzzle some readers and should certainly be cleared up in a future edition.—B.R.B.

Introduction to the Design of Servomechanisms. By J. L. Bower and P. M. Schultheiss. Pp. 510; figs. John Wiley & Sons, New York, Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 104s.

This book gives the fundamental principles of servomechanism theory, starting with an elementary approach and eventually achieving discussions on the topics of design and the effects of non-linearity. It uses the Laplace transform throughout and the second chapter, as is almost inevitable, is an introduction to this analytical tool. The mathematical standard is that of the final year undergraduate, whilst the scope of the work would cover early post-graduate research in servomechanisms. As its basis the book is formed from lecture courses at Yale University with additional material for completeness. Problems are included at the end of each chapter (without answers) and throughout emphasis is given to selected references for further study.

A large introductory section is devoted to harmonic analysis of four-terminal networks before dealing with feedback itself. The approximate assessment of gain and phase of minimum phase networks is particularly detailed. Feedback and the stability of the closed loop system is dealt with in general, followed by a large number of examples working up from simple single loop, first order systems to multi-loop systems with open-loop instability. Some mention is made of time lags or transportation lags. The design of linear stable systems is based on "an intelligently planned trial-and-error procedure." This uses the Bode diagram for the discussion of equalisers. The transient response approach is relegated to a few small sections, one of which, however, contains some original work on the error series method of determining the errors accruing from various disturbances.

The later portions of the book deal with more sophisticated topics. A large chapter is devoted to Evans' root-locus method for synthesising single- and multi-loop systems, followed by a discussion on statistical considerations leading, via power spectra, to the r.m.s. error-criterion. The closing chapters deal with non-linearities, their effects on performance and their deliberate use for particular requirements. Much use is made of the time varying techniques in the solution of non-linear systems. The book is excellently produced and the numerous diagrams are very clear. The early part will please as an introduction and the latter portions are very specialised, but the bridge between the two exists for those who wish to cross it.—J.C.W.

Principles of Frequency Modulation. Applications in Radio Transmitters and Receivers, and Radar. By B. S. Camies. Published for *Wireless World* by Iliffe & Sons, Ltd. Pp. 147; 87 diagrams. Price 21s.

This book is intended primarily for students, radio engineers and radio amateurs, for whom a knowledge of the subject is becoming increasingly important now that the incorporation of v.h.f. in broadcast receivers is standard practice. It gives a comprehensive account of the fundamentals of frequency modulation and its applications in receivers, transmitters, microwave links, radar, telegraphy and facsimile transmission. The first part deals with theory, and a number of calculations are included to illustrate the sideband structure and bandwidth of frequency-modulated waves. Some space is devoted to the relative advantages of f.m. and a.m. receivers in receiving signals in the presence of various kinds of interference.

Circuits for generating f.m. waves and their use in transmitters are next described, and a chapter on f.m. detectors leads to an account of the design of complete receivers. In the early days some f.m. receivers failed to live up to the claims made for them; the author shows how this may have been due to unsound design, and indicates how to avoid the pitfalls. He also stresses that a built-in compressed dipole aerial is unlikely to give interference-free reception in fringe areas. Numerical examples are included throughout to show how simple design calculations may be performed and to illustrate the practical magnitude of quantities.

GAS TURBINE-GENERATORS

OPERATION, LIMITATIONS AND APPLICATIONS

IN its simplest form the gas turbine consists of a compressor, a combustion chamber and a turbine which drives both the compressor and the alternator. Atmospheric air is drawn into the compressor, where its pressure is increased to several atmospheres before being heated in the combustion chamber. The hot pressurised gases are then passed to the turbine, where they expand, producing work at the shaft. The excess of turbine work over that required by the compressor is the useful output. This is known as the open cycle (Fig. 1) and is characterised by drawing its inlet air from the atmosphere and discharging the spent gases back to atmosphere.

The addition of a heat exchanger to this basic cycle improves the thermal efficiency by transferring heat from the exhaust gases to the air entering the combustion chamber, thus reducing the amount of heat, and hence of fuel, required. The cycle can be closed by substituting for the combustion chamber an air heater, in which the air stream remains uncontaminated by products of combustion and, at the same time, the turbine exhaust is led back to the compressor inlet via an air cooler. For various reasons, however, the closed cycle gas turbine has so far failed to become a popular form of power plant and it is not discussed in this article.

Thermodynamic Cycle

The thermodynamic cycle of the simple open cycle gas turbine can best be understood by reference to the temperature entropy chart for air (Fig. 2). The fact that the lines of constant pressure are curved, with a positive slope which increases with temperature, makes the gas turbine cycle possible. Consider any two constant pressure lines, P_1 and P_2, then the length of the vertical line between P_1 and P_2 can be taken as a measure of the work involved in an isentropic change between these two pressures. The curvature of the constant pressure lines involves a larger change of work if that change takes place at the high temperature end of the curves. Hence, if air could be compressed isentropically from a low temperature, then heated to a high temperature and expanded isentropically through a turbine, the turbine work output would be greater than the work input to the compressor. Of course, neither the compression nor expansion processes can be attained isentropically nor can the combustion process be attained without some pressure loss, so that the actual conditions are represented in Fig. 2 by points 1, 2, 3 and 4.

Three essential requirements must be met to obtain a large excess of turbine power output over compressor power input. These are:—(a) Turbine and compressor efficiencies must be high, (b) pressure losses throughout the system must be low, and (c) the turbine inlet temperature must not fall below a certain minimum value and for maximum output should be as high as possible.

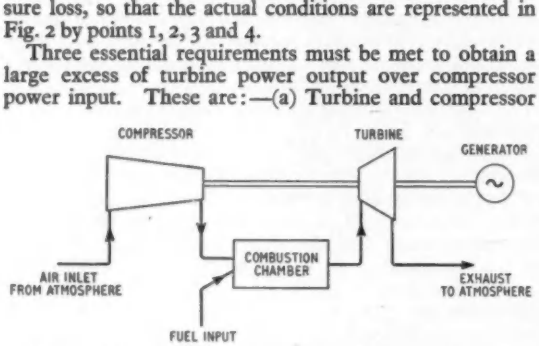


Fig. 1.—Diagram of simple open-cycle gas turbine-generator set

Compressor and Turbines

The first of the above requirements is met by careful design and by selection of the proper type of compressor and turbine. Usually, the compressor will be an axial flow machine, and though centrifugal units can be designed to have a sufficiently high efficiency for sets of small output, the axial flow machine is necessary where large outputs are involved, requiring correspondingly large volume flows. Except for the smallest sizes, turbines are invariably axial flow machines with full admission and low losses.

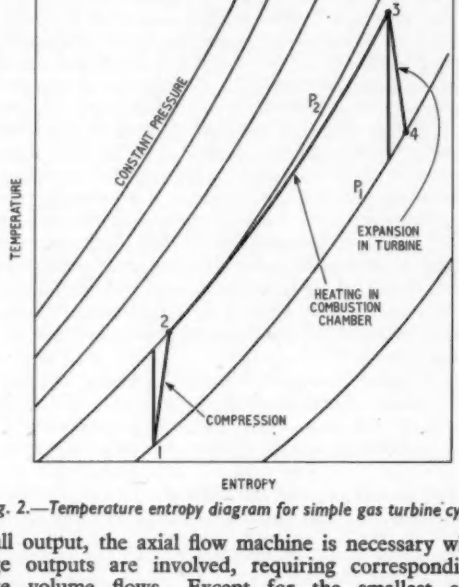


Fig. 2.—Temperature entropy diagram for simple gas turbine cycle

In the simple cycle gas turbine, there is a choice in the arrangement of turbine, between a single turbine driving both the compressor and load, and a split turbine in which the h.p. machine drives the compressor only, while the l.p. one drives the load. Either type of gas turbine can be used for driving any type of load provided the torque-speed relationships are mutually compatible. In general, however, the split turbine arrangement suits mechanical drives such as compressors, pumps, marine propellers, etc., since it makes possible a wide speed variation. For generators, a single turbine drive arrangement is better for a number of reasons, among which is an inherent governing stability rendering it very suitable for operation in parallel with other sets. An electrical load is probably unique in that the entire load can be lost suddenly and a two-shaft gas turbine having a separate power turbine of low inertia is not well adapted to accept this treatment without swinging widely in speed and, in bad cases, operating the overspeed trip when the load is shed. The single turbine arrangement, being at all times

By H. FARRINGTON, A.M.I.Mech.E.*

The operation of the open cycle gas turbine and the factors affecting its efficiency are described with particular reference to turbine inlet temperatures and the type of fuel used. The applications of gas turbines to base- and peak-load generation are discussed and two methods of integrating gas turbines into steam turbo-alternator cycles are presented

tied to a heavy aerodynamic compressor load, is much more stable. For example, a 5,000 kW gas turbine-alternator set of this type, on having full load suddenly thrown off, sustained a transient speed rise of 3 per cent, then settled back to a permanent speed rise of 2½ per cent within 45 sec, and vice versa when load was suddenly applied.

Pressure Losses

The requirement of low-pressure losses is met by careful design of inlet and exhaust casings and connecting ducts. It is generally advisable to make the manufacturer responsible for the entire system from atmosphere to atmosphere, so that his specialised knowledge is fully utilised not only in keeping the pressure losses within suitable limits, but also to ensure that ducting movements and expansions are properly catered for and that undesirable thrust loadings are not applied to the casings of the gas turbine.

Turbine Inlet Temperatures

There are two fundamental considerations, either of which can impose turbine inlet temperature limitations. Firstly, the temperature-stress-time characteristics of the materials used will impose a limit for a known stress and required life; secondly, the characteristics of the fuel which is to be burnt in the combustion chamber may be the limiting factor. For example, where the fuel is to be a clean combustible gas whether of high or low calorific value, or if it is to be a clean distillate oil, the turbine inlet temperature is generally chosen to be as high as the intended life of the machine permits. Thus, in a peak-load or standby machine, intended to run for only one or two hundred hours per year turbine inlet temperatures up to 800°C can be used. For a base-load long-life set, however, the properties of available materials impose more moderate temperatures. Machines of this type require little maintenance apart from the annual inspection and overhaul.

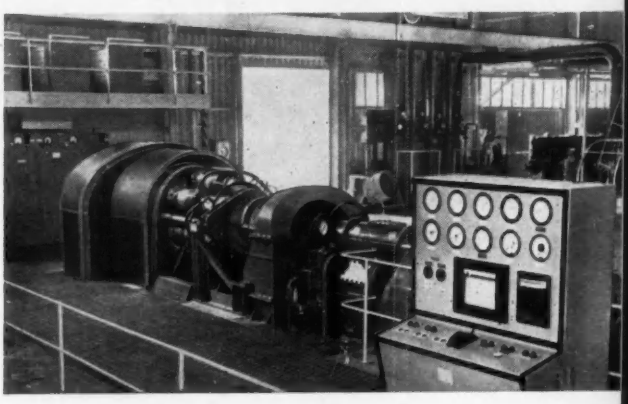
Where, however, the fuel is to be an ash-bearing fuel, such as any of the residuals, or most crude oils, this may influence the choice of turbine inlet temperature. Residual fuels burnt in a gas turbine give rise to several problems, including:—(a) Corrosion by combustion products, (b) fouling of turbine blades by deposition, (c) erosion by hard ash and carbon particles, and (d) problems associated with viscosity.

(a) *Corrosion.* Ash from residual oils, when deposited on the turbine blades may contain a number of corrosive compounds, the main constituents which give rise to serious metallurgical attack being derived from sodium and vanadium present in the ash. However, experimental evidence and experience shows that corrosion is not likely to attain serious proportions if the turbine inlet temperature is limited to about 650°C. Many turbine makers now adopt this limit with its consequent limitation of output and efficiency when an ash-bearing oil is to be burnt. An alternative method which has been used with some success in the U.S.A., is to treat the fuel before injection into the gas turbine to reduce in quantity or modify the corrosive compounds (usually in respect of their melting points) and render them innocuous.

Other forms of corrosion can occur indirectly; for example, when burning a sulphur-rich fuel, care must be taken to avoid the ingress of salt water either by leakage into the fuel tanks, by the inhaling of sea spray into the compressor intake, or by any other means. If this occurs, sodium sulphate will be formed in the combustion chamber and may be deposited in the turbine, causing corrosion.

(b) *Turbine Fouling.* Fouling of the turbine blades occurs when residual oils are burnt, the ash particles, molten in the combustion chamber, solidifying on the colder blades so that deposits build up which can cause marked reduction in turbine swallowing capacity and efficiency. This is perhaps the most awkward problem to be solved in burning heavy fuel in open cycle gas turbines. Ash-bearing fuels can vary so widely that no generally applicable cleaning schedule is available. Certain well-known manufacturers stipulate that the fuel oil must not give more than 0·02 per cent total ash and that at least 50 per cent of this ash must be soluble in water. With this restriction on the fuel, the recommended cleaning schedule for a base-load machine consists of a manual cleaning (if found necessary) at the annual shut-down, plus a turbine wash every two or three weeks. To wash the turbine, the machine is removed from service, shut down, and allowed to cool, then with the set rotating on the barring motor, either clean water or, preferably, steam is admitted through spray rings built into the turbine inlet. Drains are provided in the exhaust and the spray is kept up until the drain water runs clean, taking possibly three or four hours. The machine is then immediately put back on load. The total outage time may be about 24 hours.

Fig. 3.—A base-load 1,750 kW gas turbine-generator set operating on natural gas fuel in service for the Shell Co., of Venezuela, at La Concepcion, Maracaibo



* Turbine-Generator Division, A.E.I.

Methods of cleaning without dropping load have also been tried with varying amounts of success. These usually involve the injection at turbine inlet under air pressure of a lightly abrasive material so graded as to remove the deposits without eroding the blading material. The idea is that this can be done fairly frequently, say, once daily, or even continuously, and that it will not interfere with the normal running of the set. However, its efficacy over a prolonged period of time has yet to be proved.

(c) *Blade Erosion.* Erosion of turbine blading by hard ash and carbon particles is affected by the ash content of the fuel and by the maximum permitted turbine inlet temperature. It provides another reason for the conservative limitations on total ash and on turbine inlet temperature imposed by many gas turbine makers. Because of centrifugal effects, erosion tends to affect the outer ends of fixed and moving blades.

(d) *Viscosity.* The viscosity of heavy oils may be reduced by heating, but heating cannot be carried out to the point where vaporisation of fractions will occur. The oil must be free-flowing and free from slugs of vapour in its passage through the control valves, hence there will be a limit to the nominal viscosity of suitable oils on this account, though manufacturers' recommendations vary widely. The viscosity of the fully-heated oil as delivered to the burners will also have an effect upon the manufacturers' choice of burners. There is a fairly wide selection of burner types available, many of which have been developed successfully in boiler practice.

To avoid having the fuel lines full of a thick cold oil after a period of shutdown two methods are employed. In the first, provision is made to start up and shut down on a distillate oil which is free flowing at all normal ambient temperatures and for the lines to be flushed with distillate oil immediately after an emergency shutdown. In the second, the fuel lines are arranged so that they automatically drain immediately on shut-down while the oil they contain is still warm and free-flowing.

Applications

For base-load generation, the gas turbine must compete in the smaller-size range with the diesel engine and in the larger-size range with the steam turbine. In the lower power range, the gas turbine will usually have an efficiency inferior to that of the diesel engine of the same size, but the total generation cost may still offer a reasonable comparison because of lower costs for maintenance and for lubricating oil. If the diesel engine does not run on heavy fuel, it may be at a disadvantage compared with the gas turbine in respect of fuel prices.

In the higher power ranges, the gas turbine is competitive with the steam turbine, except where power generation is of necessity based on the use of coal. The success so far achieved in burning coal in open cycle gas turbines is extremely limited. However, if liquid or gaseous fuel is used, then the base-load gas turbine can offer thermal efficiency as good as or better than that of a steam plant of equal output. However, this usually means a departure from the simple cycle and the use of intercoolers between compression stages, reheat between turbine stages and heat exchangers in the exhaust so that the capital cost may not be very different from that of a steam set with boiler and auxiliaries. Nevertheless, such a gas turbine may show a lower generation cost than the equivalent steam plant due to a better station efficiency and lower maintenance and supervision charges.

For the largest sizes, gas turbines cannot compete with steam plant; the largest gas turbine known to be under construction is 40 MW compared with 550 MW steam plant. The economies of large steam units compared with small ones are well known and do not necessarily apply so markedly to gas turbines.

For standby or peak-load duty where the load factor is low, the simple gas turbine can offer the further advantages over steam sets of quick starting, compactness, a small circulating water requirement and lower cost of installation. Gas turbines of 5 MW size can be ready to accept load within ten minutes of starting from cold, and a 15 MW set is customarily put on full load in half an hour. The gas turbine requires no separate boiler house, hence its housing requirements are simple. The need for a water supply is also small, being confined to oil cooling requirements in simple cycle sets, and even this can be dispensed with if necessary by using air-blast coolers, rendering the set completely independent of water. Where a residual oil or crude oil is to be burnt, however, a small amount of a good quality water, such as town's supply, is required for turbine washing. It is usually possible to operate gas turbine plant with less staff than the corresponding steam station, due to the absence of the boiler and the reduction in auxiliaries.

Another peak-load use for a gas turbine-alternator set occurs where the electrical characteristics of the transmission system require the use of a synchronous condenser. This can be arranged to operate as a generator for peak-load periods driven by a gas turbine prime mover through a disconnecting clutch.

Fig. 4.—A 2,500 kW gas turbine-generator set for standby duty at the Ashford Common pumping station of the Metropolitan Water Board

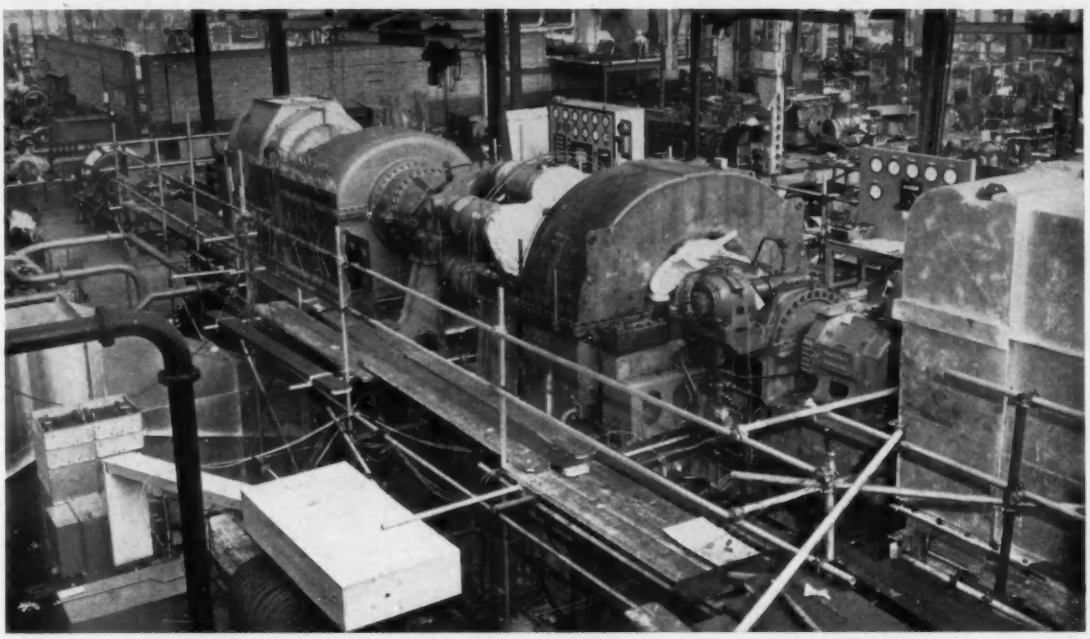


Fig. 5.—A 4·5 MW gas turbine-generator set for North Borneo on test in the makers' works

One of the largest markets for gas turbines at the present time is where the fuel is either free or very cheap, such as in the neighbourhood of many oilfields. This means that, even for continuously operating sets, thermal efficiency is not of great importance relative to other factors such as capital costs and maintenance charges, etc. Consequently, the favoured units are of the simplest type.

A further application which is finding much favour is in steel works, where gas turbines are fired by blast furnace gas. The fuel gas comes from the blast furnaces at a pressure close to atmospheric and has to be compressed to a pressure at which it can be injected into the combustion chamber through a fuel control system. Since blast furnace gas has a very low calorific value, large volumes of it are required; for example, a 5 MW set with an overall efficiency of 23 per cent would require about 13,000 c.f.m. of blast furnace gas. Hence, a gas compressor is required in the cycle, operating in parallel with the main air compressor, both feeding into the combustion chamber. The gas compressor may be either a cooled centrifugal, or an axial flow machine.

There are also, of course, many ways in which gas turbine generating sets can be used in conjunction with a steam cycle. Probably the simplest is where a waste-heat boiler is placed in the gas turbine exhaust; steam can be produced at any required pressure and temperature up to about 80 p.s.i.g., 400°F.

Developing this scheme a little further, the gas turbine exhaust gases can be used as combustion air in the boiler of a steam turbo-alternator plant, as shown in Fig. 6. An improvement in overall efficiency will result, since, if we debit the gas turbine unit with just enough of its exhaust heat to bring the thermal efficiency up to that of the steam turbine set, there will remain a considerable quantity of heat in the exhaust gases which is transferred to the steam cycle. Also, the losses due to forced draught and induced draught fans are eliminated. In this arrangement of plant, all components are fully-developed conventional units involving no new departures from well-established practice. As an example, a conventional 30 MW steam plant has an average heat rate estimated at 12,400 B.Th.U/kWh. By adding a 4·5 MW gas turbine alternator set in the above way, the total estimated heat rate can be reduced to 11,500 B.Th.U/kWh, an improvement of 7·6 per cent, combined with an increase of 15 per cent in output. The fuel assumed for this application is boiler fuel oil in both the gas turbine and in the steam boiler, but if necessary, coal could be used in the boiler and would have very little effect upon the figures quoted.

Another combination of the gas and steam turbine cycles which is receiving attention at the present time is one in which the compressor delivery air is led to the combustion space of the steam boiler. Fuel is burnt there at a pressure of several atmospheres and the gases are expanded in a gas turbine. The exhaust gases from this turbine are cooled down to a normal chimney temperature, yielding up their heat to the boiler feed-heating system. The steam generated in the boiler is passed

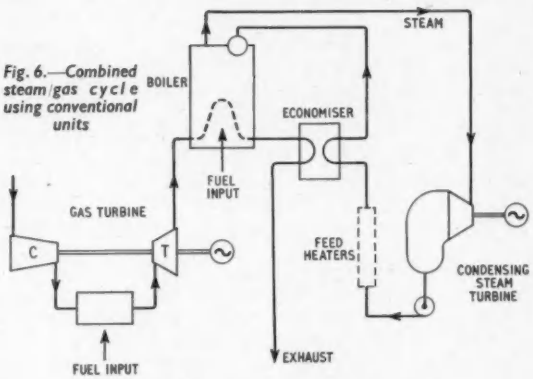


Fig. 6.—Combined steam/gas cycle using conventional units

through a steam turbine cycle which is conventional except that the bulk of the feed heating is done by the gas turbine exhaust instead of by tapped steam. This system, shown in Fig. 7, has many advantages and some disadvantages.

Firstly, the boiler casing becomes a pressure vessel and the heat transfer rates at the high-combustion-space pressures are several times higher than in conventional boilers. Hence the boiler becomes an entirely new development though there are no new principles involved in its design. Secondly, difficulties arise in respect of the fuel burnt in such a boiler. Since the combustion gases pass into a gas turbine, the same limitations on fuel apply as for a straight gas turbine. Suitable fuels are natural gas, most of the industrial gases when presented in a clean condition and most distillate fuel oils. Unfortunately, the more attractive fuels are often more expensive than coal or the heavier residual oils which are normally used in conventional steam plant and the improvement in efficiency afforded by the combined steam/gas cycle may not be sufficient to offset this difference in fuel costs.

At the present time, coal cannot be offered as a fuel where the products of combustion pass through a turbine since no completely satisfactory way has yet been found of separating the fly ash from the hot products of combustion. Work has been done in this country and in the U.S.A. upon this problem and it is to be hoped that a satisfactory solution will be found. Until then, a plant of this type can only reap the benefit of its thermodynamic advantages where the fuel is suitable. The advantages of such a plant are, firstly, a very considerable reduction in size of the steam-raising plant due to the higher heat transfer rates which are possible at the high pressures in the combustion space. Secondly, the improvement in overall station efficiency can be even greater than that given for the previous combined cycle.

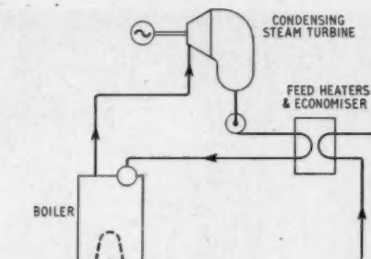


Fig. 7.—Combined steam/gas cycle using boiler with pressurised combustion space

It is, therefore, clear that the gas turbine has an increasing part to play in the production of electrical power in a wide variety of ways. An attempt has been made to indicate the limitations which apply at the present time, the removal of which is the subject of a continuous process of research and development.

Figs. 3, 4 and 5 show gas turbine-generator sets manufactured and supplied by the Metropolitan-Vickers Electrical Co., Ltd., whose gas turbine interests are now merged in the A.E.I. Turbine-Generator Division.

E.R.A. REPORTS

The second stage in an experimental investigation carried out at Queen Mary College (University of London), to determine the effectiveness of arcing devices in protecting high-voltage insulators and bushing shields from damage in still air and in wind conditions is described in Report Ref. O/T20, "The Protection of 11 kV and 33 kV Bushings from Damage by Arcs in Still Air and in a Wind," by A. E. Guile, price 12s. The first stage of the investigation, which was concerned with the mechanism of arc movement between parallel horizontal rods under the influence of the magnetic field due to the current in the rods with the interaction of wind and magnetic forces, was described in Ref. O/T19. Tests on an 11 kV bushing fitted with a single pair of arcing horns have shown that fracture of the porcelain can occur under various conditions, but that this can be avoided by fitting deflector rings and a second pair of horns in parallel with the first. In a similar way, it was shown that improved protection can be given to bushings fitted with duplex arcing horns. These results are applicable to larger insulators and assist the continuation of the investigation.

Field Breakdown

The apparatus used to determine the relation between over-voltage and formative time lags to breakdown in a uniform-field gap in air at atmospheric pressure is described, and the results so far obtained for gaps up to 4 cm are given, in Report Ref. L/T357, "The Impulse Breakdown of Uniform-Field Gaps in Air. Interim Report," by R. Galloway, price 12s 6d. The method employed involves the application of the voltage to the electrodes in the form of an impulse wave approximating to a unit function. The over-voltages used range from about 3 per cent down to zero. This work is being carried out at the Department of Electrical Engineering, University of Liverpool, under the direction of Professor Meek.

Internal Pole Decay

Report Ref. O/T17a, "The Prevention of Internal Decay in Creosoted Baltic Redwood Poles," price 6s, illustrates in photographic form the results of correct and incorrect practice in creosoting wood poles. It emphasises the need for careful selection, seasoning and creosoting, carried out under the supervision of a qualified inspector, as recommended in Report Ref. O/T17. Conformity with the following British Standards, B.S. 1990:1953, "Wood Poles for Overhead Lines"; B.S. 913:1954, "Pressure Creosoting of Timber"; and B.S. 144:1954, "Coal Tar Creosote for the Preservation of Timber," will ensure the maximum pole life.

Copies of these reports are available, at the prices indicated, from the Publication Sales Department of the Electrical Research Association at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

PROTECTION OF INDUSTRIAL DESIGNS

EXAMINATION OF EXISTING LEGISLATION

By LORD MESTON

It has been suggested that the present measures for the protection of owners of registered designs are inadequate. The existing law of the subject is reviewed by the author to show what improvements might be recommended by the Departmental Committee set up to deal with the subject

IN May last the President of the Board of Trade appointed a Departmental Committee to review the law relating to the protection of industrial designs. Mr. Kenneth Johnson, a leading member of the Bar, with an extensive practice in these matters, was appointed chairman, with seven members, all of great knowledge and distinction. The terms of reference of the Committee are:—"To consider and report whether any, and if so what, changes are desirable in the law relating to the protection of industrial designs. In framing their recommendations the Committee shall include consideration of the desirability of enabling United Kingdom designs to receive cheap and effective protection in other countries on the basis of reciprocity."

Complaints Against Present System

The existing law on the protection of industrial designs is the Registered Designs Act, 1949, as amended by the Copyright Act, 1956. There is a good deal of feeling in responsible quarters that the present law is inadequate and unsatisfactory in certain respects. These may be conveniently summarised as follows:—

(1) Where articles can be "pirated" quickly from the original (e.g. in the case of certain jewellery designs which can be easily copied by modern methods) the present system is too slow and cumbersome to give effective protection.

(2) The present procedure is too costly and too laborious if full protection is sought in the case of certain types of articles (e.g. in the toy, jewellery and pottery trades, where the market needs first to be tested or where numerous separate designs on a single theme are involved).

(3) In the case of models (e.g. toys), the more faithfully they reproduce the original object, the less chance they have of securing design registration under present arrangements.

(4) There are doubts whether, in many cases, the search for novelty now prescribed is of any value, i.e. the owners of designs would in many cases be quite satisfied with protection against straight copying of their designs and do not seek the wider protection enjoyed under the present system (i.e. they prefer the "copyright" rather than "patents" approach to design protection).

(5) "Good" designs, in the æsthetic sense, which combine simplicity and fitness for purpose are difficult to register under the present law, inasmuch as the simpler the design the less chance it has in passing the novelty test.

So much for some of the principal complaints against the present system. It may now be useful to state in rather broad outline certain features of the existing system. The Registered Designs Act, 1949, provides that the proprietor of any new or original industrial design may register it, and shall then have in respect of articles bearing that design the same sort of rights as the proprietor of a patent has in respect of the patented article.

The word "design" is defined as meaning "features of shape, configuration, pattern or ornament applied to an article by any industrial process or means, being features which in the finished article appeal to and are judged solely by the eye, but does not include a method or principle of construction or features of shape or configuration which are dictated solely by the function which the article to be made in that shape or configuration has to perform." "Article" is defined to mean "any article of manufacture" and "includes any part of an article if that part is made and sold separately."

A few words may be said about the above very important definitions. There is no real distinction between "shape" and "configuration." But "pattern" and "ornament" are not quite the same; "pattern" may include shape as well.

A design is something that has no market in itself, as apart from some article to which it is applied. Thus, showcards may be registrable, and so may any moulded or modelled representation. But a picture or drawing will only be registrable if it is a representation of some article.

Requirements for Registration

The element of "novelty" is essential. A design is not registrable under the Act "unless it is new or original and in particular shall not be so registered in respect of any article if it is the same as a design which before the date of the application for registration has been registered or published in the United Kingdom in respect of the same or any other article, or differs from such a design only in immaterial details or in features which are variants commonly used in the trade."

The whole question of novelty is essentially a matter of general impression as to which no rigid principles can be laid down. To show how complex the problem is, a difference in colour may be immaterial, but, on the other hand, it may give novelty or at least contribute to novelty. Novelty cannot be given to a design by the use of ordinary trade variants which have long been common matters of taste or choice in the trade. Nor is there registrable novelty in making ordinary and natural alterations in a known design, for instance, alterations needed to fit into a particular apparatus. Thus, alterations made to a "controller finger" for certain electrical equipment, which is already in extensive use, are not sufficient subject-matter for a design. There are certain exceptions to registrability under the Registered Designs Act, 1949. Thus, certain articles regarded as "primarily

literary or artistic in character " are excepted from registrability, as are most sorts of printed paper or cards where the dominant feature is the printing. Likewise wall plaques and medals are so excepted.

Design registrations are not intended to give protection to mechanical devices that are too trivial to be patented. It is only the actual shape or pattern of an article that can be registered, as distinct from general characteristics of a shape necessitated by a particular mode of construction. Moreover, if a design is to be registrable it must contain something more than a mechanical device in its simplest form.

An application to register a design can be validly made only by its proprietor, that is to say by the author. Where the design was " executed by the author for another person for good consideration " that other person is treated as proprietor. The application must be made by the applicant or his authorised agent on the form laid down by the Design Rules. Then follows a certain procedure which must be carefully adopted.

Let us assume now that the design is duly registered and a certificate of registration is issued to the applicant. The copyright given by registration lasts for five years in the first instance. On payment of a renewal fee it may be twice renewed for further periods of five years. The copyright is defined as " the exclusive right in the United Kingdom and the Isle of Man to make or import for sale or for use for the purposes of any trade or business, or to sell, hire or offer for sale or hire, any article in respect of which the design is registered, being an article to which the registered design or a design not substantially different from the registered design has been applied, and to make anything for enabling any such article to be made as aforesaid, whether in the United Kingdom or the Isle of Man or elsewhere."

It will be noted that the above definition contains three headings of operations which constitute infringement, namely:—(a) " Making for sale or use "; (b) " importing for sale or use "; and (c) " dealing in " (which covers selling, hiring or offering for sale or hire).

The words in this definition " make anything for enabling " render liable for infringement manufacturers of moulds, dies, blocks, plates, etc., for making an article in a registered shape or applying it to a registered pattern. In particular those words cover cases where such instruments are made here and exported, and the design is actually " applied " to the final manufacture outside the United Kingdom. They would cover the making (but not the sale) of sketches or patterns for an article of registered design or for the tools to be used in making them.

There is no infringement unless substantially the whole of the design is taken, and not just selected elements. Thus, where the article concerned is solid, " all four views " must be reproduced in the infringement. In one case the plaintiffs registered a design in respect of its application to a metal boiler for heating and warming dishes and the like for cooking purposes. The representation of the design on the Register consisted of two photographs, front and back views of a portable independent boiler. The boiler consisted of a water container round the back and sides of the fire, with a metal plate on the top and devices in front by means of which, at will, the effect of either a closed or an open grate could be obtained. The defendants registered a design for application to a " combined hot water supply boiler and cooking stove." The design consisted of a photograph of the front view of an independent boiler shown with the fire open. It was difficult by means of this photograph alone to say how the boiler could be effectively closed. It was held that the plaintiffs could not successfully allege infringement because there was nothing approaching identity between the two designs, and obvious imitation had not been established.

REFRIGERATION DEVELOPMENT

AN account of the progress made by the Domestic Refrigeration Development Committee (DoRDeC) was given by its chairman, Mr. E. G. Rowledge (Pressed Steel Co., Ltd.) at a Press gathering last week. Mr. Rowledge mentioned that DoRDeC was formed in 1956 by eight leading makers especially to promote the sale of domestic refrigerators. At that time there was a 60 per cent purchase tax and severe credit restrictions. Their aim was to instil the idea in the minds of the authorities and the public that refrigeration was not just a luxury. C. S. Services, Ltd., was engaged to conduct a campaign and Mr. Claude Simmonds became secretary of the Committee.

In 1955 the sales of domestic refrigerators totalled only 187,000; they rose in 1956 to 228,000, but in 1958 reached twice that figure. This year's sales (stimulated by a good summer) were expected to be double last year's.

Meetings had been held with the Board of Trade to emphasise that, given a satisfactory home market, refrigerator makers could greatly improve their export trade. The reduction of purchase tax to 30 per cent and later to 25 per cent and the removal of hire-purchase restrictions had had a remarkable effect. They could claim that they had now convinced people that refrigeration was an essential in the home.

The " Top Eight " show, which was a preview of refrigeration at the Ideal Home Exhibition, had been very successful. Next year (25th February) there would be a " Top Ten " show, for two other companies had joined the Committee; they expected others to become members in due course. Other functions were being arranged.

One activity of the Committee was the collection and dissemination of statistics in which non-members participated. It was believed that 86 per cent of the sales were of refrigerators of under 4·5 cu ft capacity and that still only 16 per cent of homes in this country had refrigerators.

Mr. Rowledge asked the Press to persuade housing authorities to put in kitchens big enough to take all the appliances which the housewife should have.

Other points which came out during a question and answer period were that there was a tendency for replacement refrigerators to be bigger than the original ones; that refrigerator prices had been increased to only a moderate extent in the past few years; that the supply of home-produced sheet steel was still inadequate; and that imports of refrigerators probably represented about 10 per cent of home sales.

Mr. Rowledge said that the Committee would not at present press for a further reduction in purchase tax but would combat any attempt to re-impose credit restrictions, on the ground that this would have an adverse effect on export trade.

Television Electron Microscope Images

Electron microscope images have recently been shown on B.B.C. television in programmes dealing with the basis of life and cell structure. This has been made possible through the development of the image intensifier

IN view of the recent use of electron microscope techniques in the B.B.C. "Science International" series of television programmes, it may be of interest to examine some of the developments which have been made during the last year or so without which the production of this kind of television programme would not have been possible. It should be borne in mind, however, that these developments have not been made purely for the benefit of those producing television programmes but as a means of extending the range of the electron microscope. Some idea of the progress which has been made can be gained from the fact that during the first of the television programmes poliomyelitis virus cells were shown with a factor of magnification of 1¼ million times.

Now, the conventional electron microscope provides a highly magnified image (about 120,000 times) which is viewed by means of a fluorescent screen mounted within the vacuum system of the microscope. The method of recording is generally by means of photographic plates or films, which are also inserted into the vacuum and register the electron beams falling directly on them. Direct viewing is necessarily restricted to a few observers who can look through the window of the microscope.

Viewing in the Dark

The image has to be focused and the field of view adjusted by direct viewing of the fluorescent screen and consequently sufficient beam intensity must be used to make the image easily visible. At the same time, a very low beam intensity must be used to protect specimens against radiation damage. A compromise between these conflicting conditions is usually made by operating the microscope in the dark and then the operator's eyes have to become dark adapted. Quite clearly, conditions would be easier both for the operator and any observers if the necessity for viewing in the dark was eliminated.

One method to eliminate viewing in the dark is to transfer the image electronically to display cathode ray tubes remote from the microscope and, at the same time, to intensify the image. The problems involved in doing this have been discussed for many years. The basic technique for achieving the desired result lies in the use of the television image tube, but such tubes cannot work in the dynamic vacuum system of the electron microscope because the sensitive elements would be damaged by the residual vapour present.

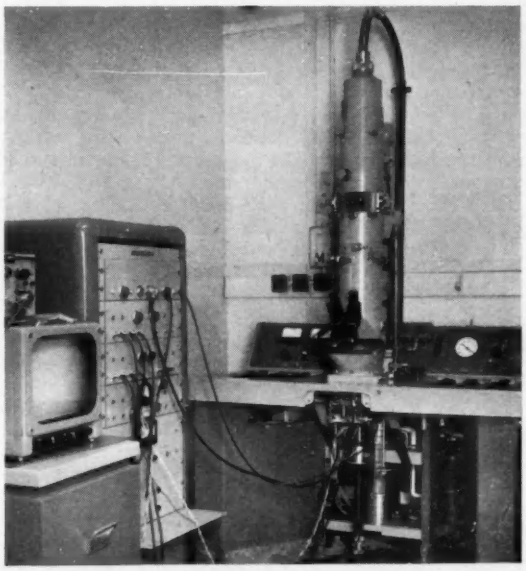
In 1955 Dr. M. E. Haine, of A.E.I. Research Laboratories, put forward a system using amorphous selenium as the sensitive material. This amorphous selenium can be exposed to air without deleterious effects. Later Haine and Einstein built an experimental apparatus and showed that not only could an image convertor tube be made to work within an electron microscope, but in addition a substantial degree of intensification could be obtained.

The operation of the intensifier relies on the increase in the conductivity of selenium which occurs when it is bombarded by high energy electrons. The primary electron beam in the microscope falls on to a layer of selenium supported on a thin plastic membrane, backed by a layer of evaporated aluminium held at positive potential. When the free surface of the selenium is scanned in a standard television raster from a low voltage electron gun, a signal appears on the backing layer which is proportional to the primary beam intensity at the position of the scanning spot. This signal is amplified and applied to a cathode ray tube scanning in synchronism.

By this means the electron intensity image in the microscope is converted into a voltage signal which can be transmitted through a television system. The intensification of the image results from the fact that several thousand electrons are released inside the selenium film for every single high energy incident electron. Efficient collection of these electrons produces a signal of reasonable amplitude for further amplification.

The system neither detracts from nor adds to the quality of the electron microscope image since, for a given exposure time, this is limited by the quantum noise of the electron beam. The intensifier is still in the experimental stage but its development is sufficiently well advanced for it to be of use in relaying the image and also for use as a focusing aid when only a weak primary intensity can be used in the microscope.

For the purpose of illustration in the B.B.C. "Science International" programmes two Metropolitan-Vickers high resolution type EM6 electron microscopes have been fitted with special image convertors of the sort described. With the assistance of the technical staff of the B.B.C. the electronic circuits have been adapted to enable the output



Metropolitan-Vickers type EM6 electron microscope as used in conjunction with an image intensifier in the B.B.C. "Science International" television programmes

of the image convertors in the microscopes to be fed directly to the television transmitter.

Hitherto a conventional television camera has been used to view the microscope screen and to transmit a picture of the view as seen by the microscope operator looking at the internal screen of the instrument. This procedure has given only mediocre results due to the various limitations outlined earlier. Since the new image intensifier will facilitate operation of the electron microscope and will probably extend the application of the instrument to make it even more versatile it is possible that further developments will result in the image intensifier eventually becoming an integral part of the electron microscope.

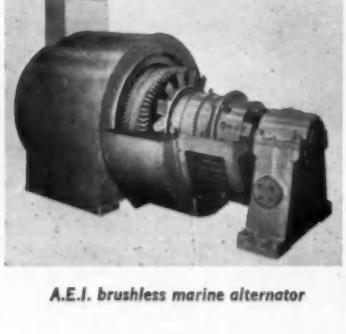
B.E.P.C. PROGRAMME

THE provisional programme of the 1960 British Electrical Power Convention, to be held at Bournemouth, under the presidency of Viscount Chandos, D.S.O., M.C., from 30th May to 2nd June, has been announced. The proceedings will begin on Monday, 30th May, with the official opening of the Convention followed by the presidential address. In the evening there will be a reception by the Mayor of Bournemouth. On Tuesday morning a paper entitled "The New Horizon—Electrical Manufacture" will be presented by Mr. H. G. Nelson, and in the afternoon a member of the Electricity Council will read a paper entitled "The New Horizon—Electricity Supply."

A paper entitled "The New Horizon—Electrical Export" will be read by Mr. E. V. Small on the Wednesday morning and one on "The New Horizon—Electricity in the Home" by Mr. T. E. Daniel in the afternoon. The annual dinner will take place on Wednesday evening. The customary Electrical Forum will be held on the Thursday morning and this will be followed by the annual general meeting, which will conclude the proceedings.

BRUSHLESS MARINE ALTERNATORS

THE range of brushless marine alternators manufactured by the Heavy Plant Division of Associated Electrical Industries, Ltd., has been extended to 1,750 kW at four- and six-pole speeds. The alternator excitation is provided by a three-phase full-wave silicon rectifier mounted on the shaft and fed from a three-phase rotating armature a.c. exciter. The excitation of this exciter is obtained from the main alternator output and is controlled by a magnestat voltage regulator. Part of this excitation is provided by saturable current transformers controlled by the voltage regulator and part by a three-phase linear reactor. The final control of output voltage is achieved by a small trimming regulator.



A.E.I. brushless marine alternator

The alternator and exciter rotors are mounted on a common shaft and the split frame of the exciter is overhung from the alternator stator, reducing the overall length of the machine. Since there are no slip-rings or commutators, carbon dust cannot be drawn into the windings. Units will be built to meet customers' individual requirements and will be provided with self-ventilated enclosures or closed air circuits suitable for sea water cooled air coolers.

Road Heating in Surrey

TO help motorists on the gradients of the new Hook under-pass under icy conditions, 360 kW of road heating cables are being installed by the Kingston-upon-Thames District contracting and mains departments staff of the South Eastern Electricity Board. The load is made up of 120 heating cables each 653ft long with a linear loading of 4·5 W/ft, giving a total rating per cable of 3 kW. These cables, manufactured by Aerialite, Ltd., consist of an enamelled copper alloy conductor insulated with polychloroprene and sheathed with p.v.c.

The cables are laid on a base course of rolled asphalt and are spaced at 6in centres by means of plastic spacer bars of B.I.C.C., Ltd., manufacture. This spacing gives an approximate output of 9 W/sq ft of heated surface. The spacer bars are fixed to the asphalt base by means of clips secured by nails driven into the asphalt. The heating cables are being covered with a 2in thickness of rolled asphalt wearing course and will be laid in one operation using a rubber tyred finisher. Each carriage way will be surfaced in two lanes of 12ft wide each.

The cables are fed from ten fuse disconnecting boxes situated in the centre reservation between the two 24ft carriage ways. The disconnecting boxes are of cast iron and watertight and they are made by Enfield Cables, Ltd. Each box is fitted with twelve 20 A fuses and arranged for 12 heating cable circuits to be balanced over three phases. The whole heating installation will be thermostatically controlled, the control instruments being supplied and installed by the Road Research Laboratory who were responsible for the design and preparation of the specification covering the complete installation.

The estimated cost of the heating installation is approximately £21/kW and the supply to the installation will be afforded under the Board's rate "A" off-peak tariff of 1d/kWh and, based on an estimated annual consumption of 150,000 kWh, the revenue amounts to £625. This will be the first road heating scheme in the South Eastern Electricity Board's area and this information has been supplied by Mr. E. A. Flint, who is the Kingston District commercial engineer.

Letter to the Editor

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Supply Industry Finances

Replying to Mr. E. W. Dorey (*Electrical Review*, 4th December), the basis of the calculations illustrated in Fig. 2 of my article is clearly stated as being the difference between the price per kWh at which the Area Board purchases and the price per kWh at which it sells to the consumers. Since the two values of kWh which form the denominators are not the same, this difference includes, and is intended to include, the cost of the losses. These losses are an important element in the overall cost of distribution which I was attempting to assess, and they account for the discrepancy to which Mr. Dorey refers.

London, N.W.11. D. J. BOLTON.

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

THE difficult problem of the aerodynamical design of electrical machines can at present be solved only by approximation methods. The problem itself is in two essential parts, viz. the design of the fan and determination of its output, more accurately, the pressure difference to be set up, and the quantity of cooling air to be supplied per second. These calculations can be considerably simplified by the introduction of flow resistances in the various sections, ducts, etc., of the electrical machine through which the coolant flows, since no accurate aerodynamical evaluation of these paths and their characteristics is possible.

There are, however, relatively simple methods of measuring the flow resistances for the whole machine. If, furthermore, sufficiently high Reynolds numbers are assumed and the duct walls taken to be rough, the resistance coefficients and, therefore, the flow resistances of the individual sections of the air paths in the machine may be regarded as constant. It is shown that the calculation of the air flow may actually be based on these resistances, which results in a great simplification of the procedure, particularly if the fan characteristic is replaced by a second order equation. Some examples of simple ducting and networks of ducts with two sources of pressure are solved in this way.—" Calculation of the Ventilation of Electric Machines," J. Hak, *Elektrotech. Z. (E.T.Z.-A)*, Vol. 80, No. 9, pp. 264-268, 1st May, 1959, in German.

Frequency-Power System Regulation

The introduction of the combined frequency-power regulation method on the Italian power systems contributing to the national grid is in preparation. It will then be necessary to distribute the task of regulation of the individual systems among several generating stations. One of the fundamental conditions of this is a knowledge of the transient behaviour of the system concerned and the matching of the system regulator to the system parameters. The dynamic response of an ideal system is determined by two parameters, viz. the mechanical time constant T_a, and the regulating energy K, the latter being the proportionality factor between power variation and the frequency deviation after termination of the transient process. Related to this parameter is what is known as " statism " of the system. The regulating energy and, to a minor extent, statism and time constant are subject to annual, weekly and daily variations depending on the variations of load cycles and the varying combinations of the generators working at the time, quite apart from the effect of the increasing rate of thermal production (in Italy).

The tests carried out in the system of the Edison groups were based on disconnections, carried out hourly during 24 hours of a normal winter working day, of between 1 and 2·5 per cent of the total power generated and, in a second test, between 6·2 and 9·9 per cent of the total output. The power variations were measured by an electrodynamic three-phase precision wattmeter, and the frequency deviations by an electronic quartz frequency meter, a convertor-type frequency meter and a frequency meter with electronic pulse counter (quartz type). The measurements of the first two frequency meters were recorded by electromagnetic oscillographs, those of the third by an operator. These instruments were placed approximately at the centre of gravity of the system (Milan). The results of the measurements and some conclusions drawn are presented.—" Determination of the Characteristic Parameters of the System of the Edison Group for Purposes of Frequency-Power Regulation," L. Priori, F. Reggiani and A. Velcich, *Energia Elettrica*, No. 3, pp. 229-236, 1959, in Italian.

Thermal Strength of Varnishes

A reproducible relationship was found to exist between the duration of the thermal stresses on a varnish film and the increment of its weight on account of moisture absorption. This was confirmed by measurements on three different types of varnish. After being kept at 130°C for various lengths of time, the varnishes were exposed for longer periods to the effect of moist atmospheres and the moisture absorption at various durations of the exposure was determined. Curves of absorption to duration of the thermal stress were plotted.

After certain periods, bends and irregularities formed in the curves, which indicated structural changes in the film. These, again, were confirmed by bending tests around a mandrel according to the standard method which showed that the elasticity of the film had decreased. A new method based on these observations was evolved which has some advantages over the conventional methods and introduces the useful concept of the " critical duration of thermal stability."—" A New Method of Determining the High-Temperature Strength of Insulating Varnishes particularly suitable for Tropical Climates," V. Houser, *Elektrotech. Obzor*, Vol. 48, No. 4, pp. 217-218, April, 1959, in Czech.

Relays using Galvanomagnetic Effect

Originally, only the rectifying and amplifying characteristics of semiconductors were used in relay engineering, but recently the Hall effect has been used in relay design. There is, however, another galvanomagnetic effect particularly suitable for this purpose, viz. the magneto-resistive or Gauss effect. This is the relationship between the electric resistance of a semiconductor and the magnetic flux density applied to it. A semiconducting material exhibiting this effect very conspicuously is indium antimonide (InSb). The optimum type of pick-up of this material is what is known as a " Corbino disc," which is placed in a plane perpendicular to the field. The production technology of these discs has been sufficiently developed to demonstrate their suitability for use in phase-discriminating, directional power and distance-relay circuits.

They possess the following advantages:—(1) Absence of a d.c. component of the unbalance current in the winding of the output relay, independently of the presence of an energising voltage and of the difference in the

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

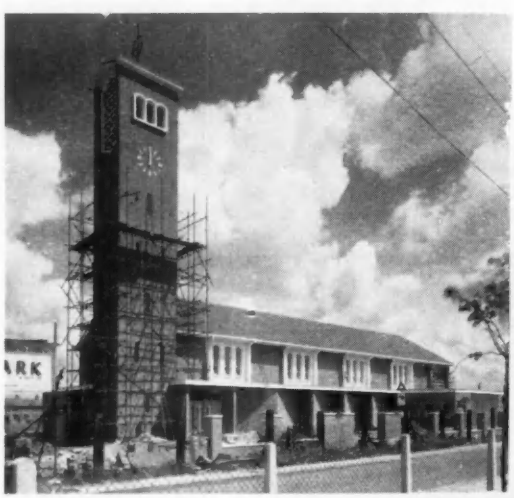
resistances in the branches of the circuit; (2) no necessity to balance or match the parameters of the energising circuit and the supply circuit of the pick-up because these circuits are not electrically connected; (3) negligible effect of temperature variations on relay operation; (4) simplicity of the arrangement. Although these advantages are shared by mechanical rectifier relays, the galvanomagnetic relay circuits have, moreover, no contacts. The theory of these relay circuits is given and encouraging experimental results are reported.—"Galvanomagnetic Directional Relays," I. M. Sirota, *Elektrichestvo*, No. 4, pp. 38-43, 1959, in Russian.

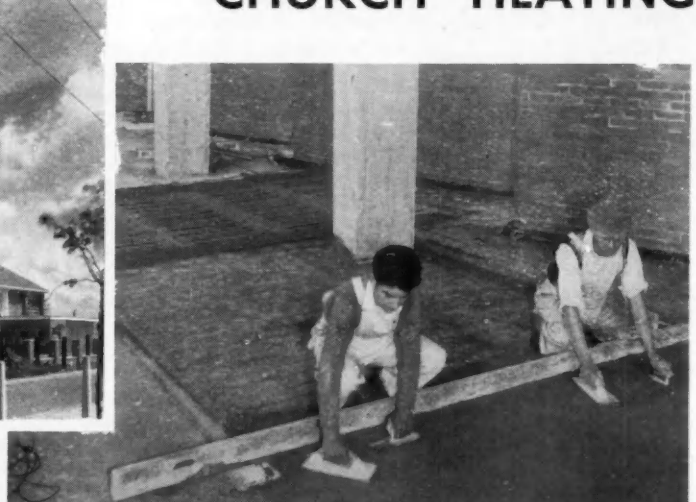
Recovery Voltage Problems

The introduction points out the advantages of the use of digital computers and network models for research on recovery and restriking voltage problems, but also the impossibility of determining amplitude factors as well as restriking frequencies by these aids. It is often assumed that the system considered can be represented accurately enough as a double-frequency circuit, but a closer examination shows that the stresses on a circuit-breaker when clearing a short-circuit cannot be reliably represented even by this method, nor is the so-called I.E.C. method suitable for this purpose. However, if we are content with picking out only the sections of the recovery voltage decisive for the breaking capacity of the breaker, without trying to represent the whole curve of the recovery voltage, four appropriately chosen parameters, which can be unambiguously determined, will serve very well.

These parameters refer to the region of the current-zero, or beginning of the recovery-voltage curve, and to that of the maximum peak of the voltage curve. The first region is decisive for the arc stability (or whether the arc will outlast the first half-wave), the second for the dielectric strength (recovery) of the break. Actually it is therefore a problem of two points of a curve, each determined by a pair of co-ordinates. For certain reasons it is best to choose the first and the maximum peaks of the curve, and the geometrical construction of the parameters is not rendered more difficult if there is another peak in between. This method is applied to the case of a "near short-circuit" on the line, to illustrate an example of double-frequency character of the recovery voltage. The intervention of the circuit-breaker is analysed by reference to an air-blast breaker of which the empirical curve of the recovery of the strength of the break is known.—"Progress on the Problem of the Recovery Voltage (Near Short-Circuit, Four-Parameter Method)," A. Hochrainer, *Elektrotech. Obzor*, Vol. 48, No. 8, pp. 395-400, August, 1959, in Czech.

CHURCH HEATING





Above: St. Swithin's R.C. Church, Liverpool. Right: Laying the top screed; the pre-formed mats can be seen in the background

FOR heating the new and attractively styled R.C. Church of St. Swithin's, Liverpool, a floor warming scheme has been provided by the Simplex Electric Co., Ltd., on the instructions of the architects, L. A. G. Prichard & Sons, the installation being carried out by Geo. A. Kelly & Co.

The installation is particularly interesting in that the Simplex system of prefabricated mats was used in addition to the normal method of laying the cable elements. These mats are prepared at the factory in standard lengths, complete with cable elements, ready for immediate laying in position on site. Cable elements around formers were used only in areas where the prefabricated mats could not be easily laid.

When laying floor warming in a church, the times when the building will be occupied have to be very carefully considered. St. Swithin's Church will be in constant use and cables therefore have been positioned in the screed to obtain maximum heat storage and benefits from the off-peak electricity tariff. If, on the other hand, the hours of occupation in a church are likely to be few, then floor construction and cable element position in the screed are designed for low heat storage and quick dissipation, and heat is automatically turned on a few hours before intended occupation. This way, of course, little or no advantage can be taken of off-peak tariffs, but the cost of heating is still low and the degree of comfort conditions high.

PARLIAMENTARY REPORT

ASKED by Mr. Nabarro for the coal equivalent of oil burned at power stations, the Parliamentary Secretary to the Ministry of Power (Mr. George) said that at the Central Electricity Generating Board's stations in 1958 the figure was approximately 4 million tons. The estimate for 1959 was 7 million, but he would prefer not to estimate for later years until the current discussions between the Generating Board and the oil companies were concluded. When Mr. Nabarro pressed for his "more realistic plans" Mr. George declined to say anything more for fear of prejudicing the discussions. He again refused to comment further when Mr. Nabarro suggested that the discussions should be brought to an early conclusion.

Interference with Television Reception

In a written reply to Mr. Abse, the Postmaster General (Mr. Bevins) said that reception of the B.B.C.'s Wenvoe television service in Forge Side, Blaenavon, had recently been subject to intermittent interference from electricity supply routes. The South Wales Electricity Board was co-operating with local Post Office engineers in finding and remedying the cause of the trouble.

Nuclear Installations Act

The Minister of Power (Mr. Wood) stated that the Nuclear Installations (Licensing and Insurance) Act, 1959, would come into force on 1st April, 1960.

Transport of Radioactive Materials

The Minister of Transport (Mr. Marples) announced that the Government hoped to publish draft regulations to control the transport by road of radioactive materials early next year. Mr. Marples was asked about revised regulations for the transport of such materials by rail and he said he understood that the British Transport Commission had almost completed its consultations with interested bodies, but it could not yet say when the regulations would be available in their revised form.

Proposed New London Tube

Asked whether he had now authorised the British Transport Commission to proceed with the construction of the Victoria Line tube, Mr. Marples said he had not, but he was carefully studying the London Travel Committee's report on the line.

Subsidies for Nationalised Industries

Mr. Spriggs asked for the total value of subsidies given to the transport, coal, electricity and gas industries since they became publicly owned. Mr. Barber, Economic Secretary to the Treasury, said no subsidies had been paid to any of these industries since they were nationalised. A number of relatively small grants were paid to the industries during the years 1935 to 1946. Mr. Spriggs said that Mr. Barber, when considering with his colleagues the making of subsidies or grants to private industry, should bear in mind that the publicly-owned industries could do with an infusion of economic help. Mr. Barber replied that these industries were able to borrow considerable sums from the Exchequer. Since 1956 they had borrowed £1,208 million.

Electricity Supply in France

DESPITE the general slowing down of expansion, the consumption of electricity in France in 1958 continued to increase at a rate greater than had been estimated and much greater than that of the general development of the economy. According to the latest report of Electricité de France, the price of electricity rose more slowly than the general level of prices and their improved financial position was due to an increase in productivity. The utilisation of the natural gas deposits at Lacq will be an important factor in maintaining this improved position, though the benefits will be offset to some extent during the coming years by the increasing volume of nuclear work. New arrangements for approving capital expenditure over a longer term, however, give a greater assurance in planning construction programmes.

Total consumption in France in 1958, including losses, rose by 7·5 per cent to 62,044 million kWh. The output of all hydro stations (E.d.F. and others) rose from 24,800 million kWh in 1957 to 32,200 million kWh in 1958; the output of thermal stations fell from 32,600 million kWh to 29,400 million kWh. Hydro stations of Electricité de France produced 23,850 million kWh in 1958, an increase of 24·8 per cent, which was 74 per cent of the total output from hydro stations. Thermal stations belonging to E.d.F. produced 12,450 million kWh or 42 per cent of the national output from thermal stations. These stations are for a large part required to compensate for changes in hydraulic conditions, and their output varied in the ratio of 1 : 3 between August (593 million kWh) and January (1,732 million kWh). Thermal efficiency increased by 6·7 per cent. Fuel used amounted to some 4·8 million *tonnes* of coal, 742,000 *tonnes* of lignite, 594,000 *tonnes* of oil and (from 1st November, 1958) 23 million cubic metres of natural gas from Lacq.

Sales of electricity (excluding exports) by E.d.F. rose by 8·3 per cent to 43,700 million kWh; 33,500 million kWh at high voltage (an increase of 8 per cent) and 10,210 million kWh at low voltage (an increase of 9·7 per cent). Exports of electricity were 646 million kWh and imports 1,062 million kWh.

The installation of five 125 MW turbo-alternators brought the installed capacity of thermal plant up to 4,537 MW. A 250 MW set for installation at Saint-Ouen was authorised during the year, and work was speeded up to enable natural gas from Lacq to be used in the new stations at Artix, Bordeaux and Montereaux. For the first time the 446 km double-circuit line between Génissiat and Paris was operated at 380 kV.

Industrial Film Making

Films have come to be regarded as one of the most potent agents in the realm of "public relations" and nowadays most of the large industrial and public service organisations use them to advertise their products or explain their policies. To many would-be users the cinema world is *terra incognita*; they have no idea of what is involved or how they should set about having a film made for them. These will be helped by a "Guide to Industrial Film Making," by Sam Black, published at 7s 6d by the Whitethorn Press, Drayton House, Gordon Street, London, W.C.1. Most of the information in this 24-page book was collected for the members of the British Electrical and Allied Manufacturers' Association, with whom the author is head of the Publicity Department.

The first section is a brief study of the nature of industrial films (including those dealing with research and education), explaining their different intentions and methods of treatment. Next, types of audiences are examined to show the different methods of approach which are necessary. Then it is shown who makes a film, and how. A third section has something to say on the important matter of cost and a fourth deals with the distribution of films at home and overseas.

Appendices contain lists of non-theatrical distributors, and of cinemas at which industrial films can be shown and the book ends with a glossary and index.

GENERATION and DEVELOPMENT

Rugeley Cooling Tower

According to a report in *The Times* a certain amount of difficulty has arisen in the construction of one of the cooling towers associated with the Rugeley generating station at present being built for the Central Electricity Generating Board. About a month ago it was discovered that a bulge had developed in the reinforced concrete shell of the tower near the base, which is raised on props about 50ft above the ground. As a result it has been decided to demolish the tower which has been under construction for about a year. Subsequently it will be rebuilt.

The design of this tower is interesting in that it is the first "dry" cooling tower to be built in this country. Basically the turbine exhaust steam is condensed in a spray condenser by using feed water in a closed circuit, the final heat rejection to atmosphere taking place in heat exchangers situated around the base of the dry cooling tower. Air flows through these heat exchangers cooling the water which then passes back to the condenser jets.

Analysis of Electricity Sales

A new return issued by the Electricity Council shows the sales to the various main classes of consumers compiled on a quarterly basis. The first of these (see accompanying table) gives the figures for the quarter ended 30th September last and for the five previous quarters, with the percentage changes over the corresponding period of a year ago. Future issues will contain the figures for the current quarter, the twelve months ending with that quarter, and the percentage changes.

The figures refer, of course, to electricity metered or billed during the period. With continuous meter reading, some of the consumption by the domestic, farm, combined domestic/commercial and part of the commercial classes will have taken place in the previous quarter. The Council states that, on a very approximate average basis, the figures for these classes might be looked upon as referring to consumption from the middle of the previous quarter to the middle of the current one. Thus the percentage changes given differ from those deduced from the monthly return, as the latter refers to complete calendar months of output from generating stations.

Third Reactor in Operation at Chapelcross

Last week the third of the four reactors at the United Kingdom Atomic Energy Authority's Chapelcross station in Dumfriesshire went into full production. Mr. G. R. Howells, works general manager, said that the fourth reactor was due to be fully operational by the end of March next, when the station would supply 140 MW to the grid as well as producing plutonium for military purposes.

Cross-Channel Cable Substation

The Central Electricity Generating Board has awarded a £220,000 contract to Richard Costain, Ltd., for the civil engineering work at the Lydd, Kent, substation which will be the British termination of the cross-Channel cable. The substation will be connected to the 275 kV supergrid which is being extended from Northfleet via Canterbury to Lydd. Power will be converted to d.c. at 200 kV for transmission through the undersea link and will be converted back to a.c. at a similar substation being built near Boulogne. The system will, of course, operate either way, depending on the direction of power flow. Civil construction work on the substation began in October and is expected to be completed in 13 months.

How Joint Consultation Works

To explain to employees in the electricity supply industry the functions of joint consultation, the Electricity Council has sponsored a film, "Talking to Some Purpose," which is to be shown at meetings at district level throughout the industry. The film, a preview of which was given in London last week, was made by R.H.R. Productions, Ltd., in association with the Film Producers' Guild and is in "Ektachrome." At the start, cartoon technique is used to stress the importance of good human relations. An employee's request for canteen facilities at an appliance repair depot, which was turned down for reasons which were not effectively explained, is then presented to illustrate how dissatisfaction can arise when consultative machinery is lacking. In the second half of the film, Sir Josiah Eccles, deputy chairman of the Electricity Council, makes a direct appeal for active support for the work of the Local Advisory Committees.

Introducing the film at the preview, Mr. D. G. Dodds, industrial relations adviser to the Electricity Council, whose appointment as deputy chairman of the Merseyside and North Wales Electricity Board was recently announced, said that the L.A.C.s had become an essential part of the industry and the aim of the film was to "get their work across" to the people they represented.

Transport Department's Profit

South Shields Corporation transport undertaking, which operates trolleybuses and motor-buses, earned a surplus of £3,465 during the year ended 31st March last.

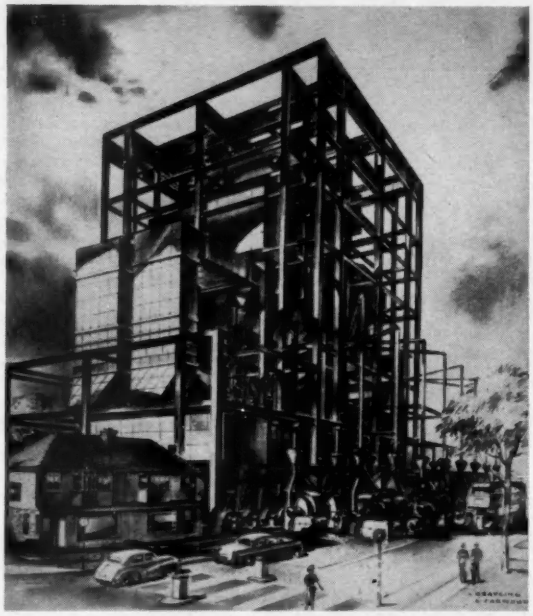
Boiler for Thorpe Marsh

A 550 MW pulverised-coal-fired radiant boiler, worth over £5½ million, is to be supplied to the Central Electricity Generating Board by Babcock & Wilcox, Ltd., for installation in Thorpe Marsh generating station, near Doncaster. This boiler, which will be the largest single-furnace unit in the world, will burn about 200 tons of coal an hour to produce steam at the rate of 3¾ million lb/hr.

When completed, the boiler will be about 170ft high. It will have a single, fusion-welded high-pressure steam drum 130ft long and weighing

ANALYSIS OF SALES BY AREA BOARDS AND THE CENTRAL ELECTRICITY GENERATING BOARD

Classification	Three months ended: June, 1958		September, 1958		December, 1958		March, 1959		June, 1959		September, 1959	
	Million kWh	Change %	Million kWh	Change %	Million kWh	Change %	Million kWh	Change %	Million kWh	Change %	Million kWh	Change %
Domestic	6,507·8	+20·9	4,695·1	+11·2	5,533·8	+ 6·8	8,200·7	+12·0	6,843·3	+ 5·2	5,006·9	+ 6·6
Farm	376·7	+22·1	284·1	+13·7	364·3	+16·5	473·1	+15·6	395·6	+ 5·0	294·7	+ 3·8
Commercial	2,462·4	+16·8	1,777·1	+ 8·3	2·395·5	+ 5·1	3,325·9	+ 8·9	2,518·2	+ 3·7	1,828·0	+ 2·9
Combined Domestic/Commercial ...	295·5	+20·8	254·8	+11·8	290·5	+ 6·7	418·7	+10·9	343·0	+ 4·0	269·9	+ 5·9
Industrial	9,181·1	+ 5·7	8,503·7	+ 2·3	10,153·0	+ 3·8	10,414·7	+ 3·1	10,063·4	+ 9·6	9,473·4	+11·4
Public Lighting	128·1	+ 9·2	136·9	+ 6·6	208·6	+ 6·7	201·0	+ 6·6	137·4	+ 7·3	148·1	+ 8·2
Traction	363·3	− 2·9	368·2	− 1·0	390·2	− 2·5	392·0	− 3·5	360·3	− 0·8	375·6	+ 2·0
Total	19,314·9	+12·1	16,019·9	+ 5·7	19,335·9	+ 5·0	23,426·1	+ 7·2	20,661·2	+ 7·0	17,396·6	+ 8·6



Artist's impression of Babcock & Wilcox 550 MW boiler for Thorpe Marsh

some 265 tons, which will be lifted into position 160ft above ground level in the course of erection.

The boiler will supply steam to the 550 MW turbo-alternator at a pressure of 2,400 p.s.i. and 1,055°F with reheat to 1,055°F.

Minister Opens All-Electric House

The millionth private enterprise post-war house at 16, Corner Green, Pont Road, Blackheath, S.E.3, which was officially opened on Monday by Mr. Henry Brooke, Minister of Housing and Local Government, is all-electric, including cooking, water heating and underfloor electric warming. The house, built by Span Developments, Ltd., is one of 23 forming the small estate of Corner Green which is itself part of a much larger development on the former Cator estate at Blackheath.

Advice for Tenants of All-Electric Flats

At Coventry and Leamington many of the new blocks of flats which are being erected will be all-electric. This means that in addition to such normal uses as lighting and cooking, electricity will be used to provide under-floor heating and constant hot water supplies. Without advice on the use of electricity, the tenants of such flats might incur heavy electricity accounts.

Following discussions between the East Midland Electricity Board and the local authorities, notes of guidance have been drawn up jointly by the Board and the Housing Departments concerned. These describe the floor-warming and hot water systems in the flats, and give advice on how to use these installations so that the best results are obtained at the least cost.

The Electricity Board has agreed to send bills for electricity to these tenants each month during the first year of occupation. As an alternative, the consumer, if he so wishes, will be able to pay a weekly sum based on an estimated use of electricity and subject to later adjustment.

Reference to this service was made at a meeting of the Area Electricity Consultative Council on 2nd December when it was decided that details should be given to all Local Committees of the Council.

OVERSEAS

Nigeria Using More Electricity

From its office in Lagos, Barclays Bank D.C.O. reports that sales of energy by the Electricity Corporation of Nigeria during the six months ended 30th September last amounted to 134·8 million kWh, an increase of nearly 15 per cent. Income rose by 21 per cent to £2,178,600.

Finland-Sweden Power Link

At the end of April this year, a 220 kV link between the Kungliga Vattenfallsstyrelsen network in Sweden and the Imatran Voima Osakeyhtiö network in Finland was commissioned. The contract between these firms was signed in Stockholm on 12th December, 1958, and by the end of August this year, 125 million kWh had been transmitted between the two countries. Even in dry years, Swedish hydro-electric resources exceed demand and surplus electricity can be transmitted to Finland. Joining the networks improves the frequency stability of the Finnish grid system and provides a reserve source of power for the two countries.

Uganda Board to Supply Kenya Areas

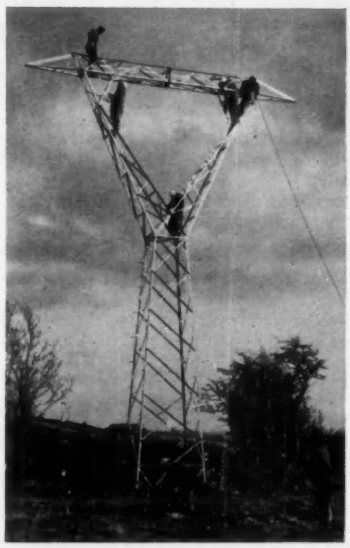
Co-operation between Uganda and Kenya in the matter of electricity supplies has been taken a step further by the granting of two distributing licences empowering the Uganda Electricity Board to supply electricity directly to consumers at Busia and Itesio Leprosarium in Kenya. Both distributing areas will be administered from the Board's district office at Tororo.

Spain Agrees to Exchange Electric Power

Following its recent admission to the Organisation for European Economic Co-operation (O.E.E.C.), Spain has decided to liberalise the exchange of supplies of electricity across its frontiers.

Over two-thirds of Spain's electricity is generated by hydro plant. The country is handicapped by highly irregular rainfall and, in spite of substantial reserve capacity, power supplies are often difficult during years of drought. The liberalisation measures to which Spain has now acceded will enable it to draw on neighbouring countries during a shortage. The first sources of supply will be Portugal, which already controls a number of rivers jointly with Spain, and France. Other more distant countries, however, such as Belgium, Germany, Italy and Switzerland, may also supply power to Spain by concluding compensatory agreements with France. Conversely, whenever hydro conditions in Spain are good, any surplus power can be exported to those countries which have come to its assistance in emergencies.

Like any other of the countries involved in such exchange, Spain will be able to rely on more regular power supplies and make economies in its investment programme for reserve generating equipment.



A new type steel mast being used by the Electricity Supply Board, Dublin, for the 110 kV line between Dundalk and Cavan. These light steel masts were designed in Italy and the prototype was tested to destruction by loads arranged to simulate the ice and wind conditions experienced in Ireland

INDUSTRIAL NEWS

Cable Price Increases

Following the recent announcement by British Insulated Callender's Cables, Ltd., of an increase of 7½ per cent in the price of its l.v. mains cables, Associated Electrical Industries has announced that the prices of its l.v. mains cables have been increased by between 2½ per cent and 7 per cent, with effect from 1st December. The increase will apply to most customers and to others as soon as current contracts are completed. It is also announced that the Pirelli-General Cable Works, Ltd., is raising the prices of its l.v. mains cables in the near future.

The Hunterston Stoppage

Prolonged talks on 2nd December failed to produce a settlement in the dispute at the nuclear power station being built at Hunterston, Ayrshire, by the G.E.C.–Simon-Carves consortium for the South of Scotland Electricity Board. The Motherwell Bridge & Engineering Co., Ltd. (a member of the group), on 5th September ceased operations on its £8 million contract and suspended 500 men because of a long series of unofficial strikes.

A joint statement after the meeting said that, in an attempt to establish conditions under which work could be resumed, the company had tabled proposals for a wages structure which necessitated further study, and it was agreed to adjourn the meeting until 30th December to permit individual unions to negotiate with the company.

The station was intended to begin producing power in 1961. It is estimated that work on the Motherwell company's contract, one of the most important at the site, is now 15 months behind schedule as a result of unofficial strikes and the present stoppage.

G.E.C. and Plessey Co-operate

An arrangement has been entered into by the Semiconductor Division of the General Electric Co., Ltd., and Semiconductors, Ltd., of the Plessey group of companies, whereby each technical sales force will handle information on the products of both organisations.

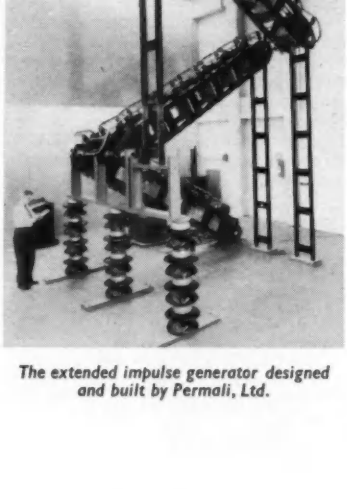
Furnace Transformer for Steel Works

Associated Electrical Industries, Ltd., Transformer Division, is supplying a large arc furnace transformer to the English Steel Corporation, Ltd., River Don Works, Sheffield, in conjunction with Birlec-Efco (Melting), Ltd. The transformer will be 20,000 kVA, 3-phase, 50 c/s, supplied at 33,000 V. It will be cooled by forced oil circulation through an oil-to-water heat exchanger. The equipment will consist of an untapped furnace transformer, an auto-wound voltage regulator to control transformer input voltage, and an auxiliary reactor, all contained in one tank. The voltage regulator and the auxiliary reactor will have tappings connected to two separate motor-operated on-load tap-changers. Both tap-changers will be remotely controlled from the control panel by the furnace operator.

Impulse Generator Structure

Densified wood structural and insulating members act as the main supports in the multi-purpose impulse generator structure designed and built at the United States factory of Permali, Ltd., Gloucester, and installed in the high voltage laboratory of the Joslyn Manufacture Supply Co., Chicago. The generator consists of three capacitor banks, arranged in parallel, which may be extended or used in a folded position. This structural design was evolved to cater for the extreme range of impulse voltage test requirements. An overhead crane, held in position by vertical densified wood ladders, is used to extend the capacitor banks, which are then connected in series to give an open circuit output voltage of 1·8 million volts. With the correct external parameters, 1·5×40 microsecond impulse voltage tests can be performed on insulator strings, cross arms, guy strain insulators, etc. In addition, studies can be made of the effects of fast rates of voltage rise.

Voltage tests of up to 600 kV can be made with the impulse generator in the folded position and the relatively high voltage with low circuit inductance makes it possible to raise the surge current at a rate of about 40,000 A/sec. The folded arrangement is used mainly for studying the protective ability of lightning arrestors. Low-current long duration test waves can also be obtained for testing lightning arrestors by the use of inductors between the capacitors.



The extended impulse generator designed and built by Permali, Ltd.

Royal Visit to Bedford

The Duke of Edinburgh paid a visit to Queen's Engineering Works of W. H. Allen, Sons & Co., Ltd., Bedford, on 4th December. The visit coincided with the commencement of the 80th year of the company's existence. Accompanied by Mr. W. K. G. Allen, the Lord Lieutenant and Mr. H. N. G. Allen, the Duke visited the training centre where he saw examples of the work being carried out by the apprentices, and he then toured the various sections of the works. After tea with the chairman and directors, the Duke unveiled a plaque to commemorate his visit and the opening of the recently-completed six-storey office block.

Rectifier Order from Norway

The Heavy Plant Division of Associated Electrical Industries, Ltd., has secured a contract from Norway for a 108,000 kW rectifier installation required in connection with aluminium smelting. The contract has been placed by Ardal og Sunndal Verk, the equipment being for extensions to an existing plant at Ardal—situated at the head of the Sognefjord on the west coast of Norway. The order covers semiconductor rectifier equipment rated at 135,000 A, 800 V d.c., and the plant is to be commissioned and in commercial operation early in 1962. The transformers required to operate with the rectifier equipment will be manufactured in Norway by A/S Rich Pfeiffer, with whom A.E.I. has collaborated in the overall design of the installation.

London Wholesalers' Showrooms

Although Newey & Eyre, Ltd., electrical wholesalers, moved into their new London premises at 186, Acton Lane, Harlesden, London, N.W.10 (telephone: Elgar 6381) in May of this year, the official opening ceremony was delayed until last week in order to coincide with the opening of their recently finished trade domestic showroom which marks the completion of the building. Many retailers and trade friends of the company were entertained during "open evenings" last week and the opportunity was also taken to stage a demonstration of "Sunbeam" domestic electrical equipment.

The showroom, well lit and stocked with a wide variety of domestic appli-

ances and fittings, covers a fairly large area and is conveniently situated to the left of the main entrance foyer. Both large and small appliances are displayed and maximum use has been made of below-counter space. The whole has been sub-divided into glass-fronted compartments and each houses a different type of coal-effect fire.

The trade counter is to the right of the main entrance and above are the offices—together forming the main frontage of the building. Extending to the rear of the premises is a well-stocked stores area, occupying approximately 14,000 sq ft, served by a goods inwards bay and two dispatch bays. Being a single-storey building, everything is at ground level, which greatly facilitates loading and unloading.

This London branch is one of the seventeen Newey & Eyre branches and subsidiary companies situated in the larger provincial towns, and Scotland. With a staff of thirty, and five vans, it will serve the Greater London area and the Home Counties, under the management of Mr. A. G. Cooper, assisted by Mr. W. Wallace, service manager.

Elliott-Automation in France

Elliott-Automation, Ltd., announce that negotiations are proceeding with Manufacture de Machines du Haut-Rhin S.A. ("Manurhin") of Mulhouse, France, with a view to arrangements being made for the manufacture in France of automation equipment.

South Wales Institute of Engineers

The annual dinner of the South Wales Institute of Engineers will be held on 21st January at the Park Hotel, Cardiff. Tickets (£1 1s each) can be obtained from the Secretary of the Institute, Park Place, Cardiff. Applications should be made by 13th January.

Instrument Travelling Exhibition

Negretti & Zambra, Ltd., recently staged an exhibition of instruments for temperature measurement and control at Cardiff, Birmingham, Manchester, Glasgow, Newcastle, Sheffield and Nottingham. The exhibition consisted of twelve exhibition units on which were displayed many types of temperature measuring instruments and temperature controllers. A re-styled transmitter together with "on-line" and "on-plant" controllers and a new "Aetec" range of thermo-electric temperature indicators and controllers were shown for the first time.

New L.E.W. Bristol Premises

The London Electric Wire Co. & Smiths, Ltd., and its associate companies, Frederick Smith & Co., Vactite Wire Co., Ltd., Millett Levens (Engravers), Ltd., and Printed Circuits, Ltd., have opened new

The new Bristol branch premises of the L.E.W. group of companies

premises at 11/12, King Street, Bristol. This building with modern offices and expansive storage area enables a large increase in stock, covering a comprehensive range of products, to be held. The opening ceremony was performed by Mrs. E. L. Wildy, who was accompanied by Mr. E. L. Wildy, chairman and managing director of the L.E.W. group of companies.

Institution of Works Managers

At the annual general meeting of the Institution of Works Managers on 27th November and the Council meeting on 28th November, it was decided to create a new regional structure. The first two Regional Boards will be for the North and the South of England. In due course a third for the Midlands will also be established and, in time, others. The Boards will act as an additional liaison between the branches and head office and will deal with much that is mainly of regional interest. Under its new chairman, Mr. D. Bonney (Stewarts & Lloyds, Ltd.), the Council also approved a revision in the structure of the functional committees. This will have the effect of streamlining the administration of day-to-day matters, and pave the way for more rapid expansion.

Electric Vehicles for Central America

Smith's Delivery Vehicles, Ltd., has just completed an export order for the Republic of Honduras. Negotiated through Transatlantic Engineering, of London, S.W.1, the order covers NCB electric "Commuter" dairy trucks which will be operated in San Pedro Sula by a milk factory sponsored jointly by the National Development Bank of the Republic of Honduras and U.N.I.C.E.F.

Based on the 1-ton "Commuter" chassis, with stand-sit drive, walk-through cab, the vehicles are fully enclosed with full-length sliding cab doors, and full-width rear loading doors. The body shell, including floor and the sliding door between cab and body, is fully insulated. "Exide Ironclad" batteries, of 36 cells, 332 Ah capacity, provide the power and the electrical control and motor equipment has been manufactured by A.E.I., and the battery chargers by the Westinghouse Brake & Signal Co., Ltd.

Production Still Rising

Production in the engineering and electrical goods industries increased substantially in September, according to the latest figures issued by the Board of Trade. Output was 11 per cent more than in September, 1958, and in the third quarter it was 8 per cent more than in the corresponding period of 1958. Preliminary estimates for October indicate that production continued at about the same level. But order books again remained unchanged and orders for export have fallen slightly. The Board of Trade says that October figures are unlikely to show any marked change.

Japanese Nuclear Power Contract

A further stage in the progress towards the conclusion of a contract for a 150 MW nuclear power station between the Japanese authorities and the General Electric Co., Ltd., was reached last week. Then the Japanese Atomic Energy Commission formally recommended the placing of the contract. The station is to be situated at a place about 70 miles north-east of Tokyo and much of the constructional work and the provision of generating equipment will be done by Japanese concerns.

Railway Electrification Rolling Stock

British Railways' workshops are to build another 648 electric train vehicles, the British Transport Commission announced recently.

They have been ordered by the Commission for railway electrification programmes in the North-West, North-East London, and Kent. The orders are valued at £10,000,000. The vehicles are to be built in the railway workshops at Doncaster, Eastleigh, Wolverton and York.

For the electric train services to be introduced next September between London (Liverpool Street) and Enfield, Chingford, Hertford East, and Bishop's Stortford, 232 vehicles are to be built, seventy-six of them at the Doncaster works and 156 at York.

The vehicles built at York will form fifty-two three-car train sets for the Enfield and Chingford services, and those from Doncaster will comprise nineteen four-car trains for the Hertford East and Bishop's Stortford lines. Electric trains are also to be introduced next September between Manchester and Crewe, and sixty electric vehicles to form fifteen four-car units are now being built at Wolverton

works for this service. A further eighty electric train vehicles have now been ordered to form twenty four-car units, and these will be built at Wolverton next year for the Liverpool-Crewe service. It is hoped to complete the electrification of the main line from London (Euston) to Birmingham, Liverpool and Manchester by 1964, some three years earlier than was originally planned.

Work is in progress on the second phase of the Kent Coast electrification scheme, which, the Commission says, it is hoped to complete by June, 1962, when all main lines in Kent will be electrified. This second phase will project electrification from Sevenoaks and Maidstone via Ashford to Folkestone and Dover. For these services, 336 electric train vehicles are to be built by the Eastleigh works.

French Imports Liberalised

A number of electrical appliances are included in the additions to the list of goods which may be imported into France without quantitative restrictions, when originating in and coming from member countries of the O.E.E.C., and their dependent overseas territories. The list published in the *Board of Trade Journal* mentions electric blankets, dry shavers, refrigerators, instantaneous or storage water heaters and immersion heaters, soil heating and space heating apparatus and irons.

Management Conference

The national conference of the British Institute of Management was held recently at Harrogate. Among the papers which were read and discussed were "Reaction of Trade Unions to Automation," by Mr. J. A. Birch, general secretary, Union of Shop, Distributive and Allied Workers; "Production Problems in the Smaller Company," by Mr. B. M. Harris, managing director, Gerard Brothers, Ltd.; and "Management Approach to Standardisation and Simplification."

Whitaker's Almanack

The 1960 edition of "Whitaker's Almanack" once again contains a vast amount of varied information. Full details of the General Election held last October are given, including an alphabetical list of the newly-elected Members of Parliament. In addition to regular and traditional features of the Almanack, a number of new articles have been added. For the first time a list of all Public Acts of Parliament passed during the last session has been included, with notes on their more important provisions. Progress during the year of scientific development is recorded.

A new article, giving particulars of all the leading universities of the Commonwealth, has been added to the Education Section. Many new statistical tables which have been added include the finance of the nationalised gas and electricity industries. The complete edition (over 1,190 pages), bound in cloth boards, is priced at 21s, and the shorter edition (692 pages), paper bound, at 11s 6d. The library edition (bound in leather with coloured maps) will be available this month, price 37s 6d. The Almanack is published by J. Whitaker & Sons, Ltd., 13, Bedford Square, London, W.C.1.

Ferranti Data Processing System for Sweden

An order worth about £280,000 has been placed with Ferranti, Ltd., by the A.B. Turitz concern of Gothenburg, Sweden, for the first "Orion" data-processing system. The Swedish company, which operates the largest chain of multiple stores in Sweden as well as several large independent stores, will make use of "Orion" for data-processing and stock control. It is expected that it will be installed about the end of 1961.

A production line for "Orion" computers has been laid down at Ferranti's West Gorton factory, Manchester. Two other machines will go into service at the company's Computing Centres in London and Manchester.

Free Trade Association

The Stockholm Convention setting up the European Free Trade Area—the Outer Seven—has now been published as a White Paper (Cmd. 906, H.M.S.O. 3s).

It sets out in detail the objectives of the new association, the procedures for removing tariffs and quotas, the "rules of competition," and the timetable to be followed. It also describes the arrangements for complaints and consultation between members, and the permitted exceptions from the provisions for the removal of trade barriers.

A further White Paper (Cmd. 906-1, H.M. Stationery Office, 7s) sets out the goods which qualify as finished products from within the area of the Outer Seven and the processes by which they qualify. Under the Association's origin rules, goods will qualify for area treatment if not more than 50 per cent of the export price is accounted for by non-E.F.T.A. materials or alternatively if the finished product has undergone certain processes within the area.

Diesel Generating Plant for Nigeria

A contract for diesel generating plant, to be installed and in operation by 1960 in the remoter parts of Nigeria, has been received by Blackstone & Co., Ltd., Dursley, Glos., from the Nigerian Government. The plant is to be installed as part of the Government's project for the distribution of electrical energy throughout certain parts of the country. Nine ER2/75 kW, ten ER3/116 kW, and six ER6/234 kW sets, each consisting of a radiator cooled "Lister Blackstone" engine, direct coupled to an Electric Construction Co. alternator, on skid type baseplates, are to be installed in ten different centres. The Electricity Corporation of Nigeria is responsible for the supply and distribution of electrical energy in Nigeria.

Lord Citrine's Lecture

A few guest tickets for the talk by Lord Citrine, "Impressions of the Antipodes" (dealing with his visit to Australia and New Zealand) are still available from the General Secretary, A.S.E.E., 23, Bloomsbury Square, London, W.C.1. At the end of his informal talk Lord Citrine will show a colour film of the Snowy Mountains hydro-electric scheme, lent to him by the Snowy Mountains Authority.

Lines over School Grounds

Four judges in the Court of Session, Edinburgh, on 4th December upheld a decision given by Lord Cameron in the Outer House two weeks earlier (see *Electrical Review*, 27th November, p. 749) when he refused to grant interim interdict to prevent the North of Scotland Hydro-Electric Board from erecting overhead cables across the grounds of the Rudolf Steiner School, Newtondee, Aberdeenshire.

The petitioners, Camphill (Rudolf Steiner) Schools, Ltd., Aberdeen, in their original application, had sought an interim order pending the hearing of an action of interdict and declarator against the Board. They alleged grave danger to pupils of the school who would be tempted to climb the pylons and touch 132 kV lines. They also averred that it was the only case in Britain of high-voltage cables being carried across school grounds.

Airmec Exhibition

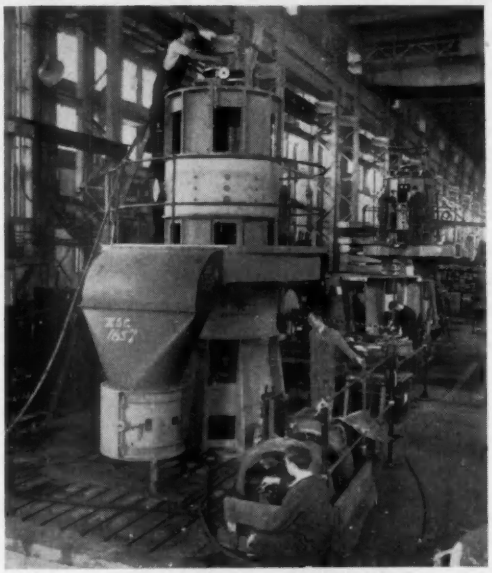
The annual Airmec exhibition will be held from 18th to 22nd January at Napier Hall, Hide Place, Vincent Square, London, S.W.1. Admission is by ticket obtainable from Airmec, Ltd., High Wycombe, Bucks. The exhibition will, as usual, show the full range of Airmec electronic instruments and industrial control equipment, and representatives of the company will be in attendance to take inquiries and demonstrate any instrument.

Educational

The latest edition of "Engineering Education in the Region," issued by the London and Home Counties Regional Advisory Council for Technological Education, Tavistock House South, Tavistock Square, London, W.C.1 (price 3s 6d), is intended to assist men and women in London and the Home Counties who wish to follow a recognised course in some branch of engineering and it lists the courses at the various colleges during the academic session 1959-60.

Gas-Circulator Motors for Hunterston

The accompanying photograph shows two of the sixteen gas-circulator motors for the Hunterston nuclear generating station under construction



Gas-circulator motors for Hunterston under construction at the Witton works of the G.E.C.

in the Witton Engineering Works of the General Electric Co., Ltd. The double-armature type, 1,230 V d.c. motors develop 2,354 h.p. running at 1,040 r.p.m. One is already installed on site, where it is being used for tests on the gas-circulator system. The station is being constructed by G.E.C.–Simon-Carves for the South of Scotland Electricity Board.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £252 0s 0d
Fire Refined 99·70%	ton £251 0s 0d
Fire Refined 99·50%	ton £250 0s 0d
COPPER Tubes ..	lb 2s 5½d
Sheet	ton £286 15s 0d
H.C. wire and strip ..	ton £303 5s 0d
LEAD, English ..	ton £71 10s 0d
Foreign	ton £70 0s 0d
MERCURY	flask £71 10s 0d
TIN, block (English) ..	ton £788 0s 0d
ZINC, G.O.B. Foreign	ton £94 10s 0d
BRASS Tubes (solid drawn)	lb 2s 0½d
Wire	lb 2s 9½d
PHOSPHOR BRONZE Wire	lb 4s 2½d
PLATINUM ..	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 35d—35½d

Signalling Indicator for Parkside Colliery

The North-Western Division of the N.C.B. has placed an order with Heyes & Co., Ltd., for two 5-level type 40 shaft signalling indicator systems for installation with the two winders in No. 1 shaft at the new Parkside Colliery, Newton-le-Willows, which is due for completion next spring. Each system consists of a fabricated steel floor mounting cabinet containing five level relay groups, each being arranged with destination hold and emergency stop facilities. The line relay is fitted with contacts for the operation of a signal recorder and the emergency stop relay is fitted with extra contacts for use in the winder safety circuit if required. The interlock reset relay and the bank level indicator relays are also mounted in the cabinet. Mounted in the right-hand side of the cabinet and isolated from the relay cabinet, are a 12 V "Nife" battery and automatic charger, with the display lamp transformer and mains fail relay. Five luminous signal display panels, each giving origin signal, emergency stop signal and statutory signals are specified together with seven additional displays, link disconnecting joint boxes, signalling keys, bells, relay groups and indicators at each level.

Productivity Films

Four admirable new films by the British Productivity Council were shown in London last week. Each presents, in a simple and direct way, a problem and a solution. The subjects dealt with are quality control ("According to Specification"), suggestion schemes ("People Have Ideas"), opportunities for boys at technical colleges ("Training for Industry") and the human factor in work study ("A Company of Men"). Each film runs for approximately thirty minutes and can be bought from the British Productivity Council or borrowed from the Central Film Library, Government Building, Bromyard Avenue, Acton, London, W.3.

Trade Announcements

The **Incandescent Group** of companies, which includes the Incandescent Heat Co., Ltd., Metalectric Furnaces, Ltd., Controlled Heat & Air, Ltd., and Selas Gas & Engineering, Ltd., has opened an area office at 40, Newport Road, Cardiff (telephone: Cardiff 37715), under the management of Mr. J. W. Payne.

Alma Components, Ltd., has appointed AB Solartron of Hedinsgatan 9, Stockholm, as their agents for precision wirewound resistors in Sweden.

K & L Steelfounders & Engineers, Ltd., a member of the George Cohen 600 Group of companies, are to expand their Engineering Division. A lease has been arranged for one of the Board of Trade factories at Newburn-on-Tyne. It has a floor area of 24,000 sq ft.

Denham & Morley, Ltd., distributors of Scharpf washing machines and spin dryers, have moved to new premises at 175, Cleveland Street, London, W.1, which incorporate showrooms, office accommodation and storage facilities. The full Scharpf range is displayed, together with other products which Denham & Morley are marketing.

Datum Metal Products, Ltd., has moved into a new and larger factory on the Colne Way Trading Estate, By-Pass, Watford (telephone: Watford 22351). A new office block is nearing completion for the sales and administrative staff.

A new material in mild steel sheet, hot dip coated with aluminium, known as "Aludip," is now in production in this country in a limited range of sizes and gauges by **Coated Metals, Ltd.,** whose sales office is at Palmerston House, Bishopsgate, London, E.C.2.

M.K. Electric, Ltd., has moved to Shrubbery Road, Edmonton, London, N.9. The telephone number (Edmonton 5151) is unchanged.

Calendars

Brook Motors, Ltd., has sent us a desk calendar for 1960, the monthly cards of which also show the preceding and following months. On the back of each card is an illustration in colour of one of the company's motors.

The calendar of the Westinghouse Electric International Co. has large sheets, each showing three months and surmounted with pictures in colour of world capital cities.

Stewarts & Lloyds, Ltd., have again sent us a neat desk calendar with monthly cards.

New Electrical Exhibition Company

Electrical Fairs, Ltd., has been registered as a private company with a nominal capital of £100. Its stated objects are "To institute, promote and participate in exhibitions for the display, in any part of the world, of the history, achievements and products of the electrical industry, etc." The subscribers are Messrs. R. F. Mathieson, J. H. K. Pendry and E. J. Sutton, who are all members of the Council of Management of the Electrical Engineers (A.S.E.E.) Exhibition, Ltd.

The new company will be responsible for the domestic electrical appliances exhibition which is to be held at the Alexandra Palace, London, in the autumn of next year.

Change of Address

Mr. T. Dunwoody, consulting engineer, has moved to 25, Bruton Lane, Berkeley Square, London, W.1 (telephone: Hyde Park 1481/2/3), and the firm's title is now T. Dunwoody & Partners.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Council for Scientific and Industrial Research has authorised changes in the terms of reference of the Radio Research Station, D.S.I.R., and has appointed **Mr. J. A. Ratcliffe,** C.B.E., F.R.S., M.A., M.I.E.E., to be the new Director from 1st October next year, when the present Director, **Dr. R. L. Smith-Rose,** C.B.E., retires.

Mr. J. A. Ratcliffe

Mr. Ratcliffe is head of the Radio Section at the Cavendish Laboratory at Cambridge. He was educated at Giggleswick School and Sidney Sussex College, Cambridge. Joining the Cavendish Laboratory in 1924, he worked with Sir Edward Appleton in his researches on the ionosphere and since then has done much work on the propagation of radio waves.

Under its new terms of reference the Radio Research Station will undertake investigations of the upper atmosphere and outer space by both radio and non-radio methods.

The activities of Marconi's Wireless Telegraph Co., Ltd., in the military, scientific, industrial, commercial and educational applications of closed circuit television (both black-and-white and colour) have developed to the stage where a separate Product Division is required in order to co-ordinate and further expand them. Accordingly, a Closed Circuit Television Division has been formed and the following new appointments have been made:—

Mr. V. J. Cooper, B.Sc., A.C.G.I., M.I.E.E., M.Brit.I.R.E., has relinquished the post of chief television engineer—an office which ceases to exist—to become manager and chief engineer of the new division. **Mr. J. E. H. Brace,** B.Sc., has been appointed deputy manager and chief of sales and contracts of the division, and **Mr. N. N. Parker-Smith,** B.Sc., A.M.I.E.E., is appointed chief development engineer.

The formation of the new division has made certain changes necessary in the Broadcasting Division and as a consequence the following appointments have been made:—**Mr. G. E. Partington,** B.Sc., A.M.I.E.E., is appointed chief engineer, Broadcasting Division, and **Mr. J. F. James,** B.Sc., M.I.E.E., is appointed chief development engineer.

Mr. A. Noël Smith, Mr. H. F. Smith and **Mr. Ernest Leete,** all of whom have served for varying periods as joint managing directors of the London Electric Wire Co. & Smiths, Ltd., will be retiring on 31st December after an association in each case of over fifty years.

When the present company was formed in 1909 by an amalgamation of the copper interests of Frederick Smith & Co. Halifax, Ltd., and the London Electric Wire Co., Ltd., Mr. Noël Smith was appointed to the board and has been a director ever since. He was elected chairman in 1953, which position he held until 1957 when he was succeeded by the present chairman, Mr. E. L. Wildy.

Mr. Leete was the first secretary of the present company and was appointed to the board in 1912. After serving as hon. treasurer of the I.E.E. for three full terms, he was elected an honorary member in 1954 and continues to play an active part in the affairs of the Institution.

In 1914, on the death of his father, Mr. Frederic Smith, one of the original directors of the company, Mr. H. F. Smith was appointed a director, and from that date until 1934 he was responsible for purchasing the company's copper supplies. Since then, while retaining his seat on the board, he has been a consultant of the company.

Mr. V. Southon, Associate I.E.E., has been appointed chief inside sales engineer and office manager of the Toronto office of E.C.C. Canada, Ltd. Mr. Southon was recently secretary-treasurer of the Electrical Maintenance & Repairs Co., and was formerly with the Hydro-Electric Power Commission of Ontario and senior assistant commercial officer with the Eastern Electricity Board in England. E.C.C. Canada, Ltd., is the Canadian organisation owned by the Electric Construction Co., Ltd., and George Ellison, Ltd.

The following appointments are announced by Philips Electrical, Ltd.:—**Mr. I. F. Davies,** B.Sc., A.M.I.E.E., to be an executive engineer with the Lamp and Lighting Group. Mr. Davies joins Philips after eight years' service with the research laboratories of the General Electric Co., Ltd.

Mr. I. F. Davies

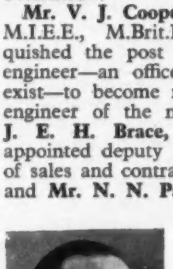
Mr. M. G. A. Jackson

Mr. M. G. A. Jackson to be manager of the Lighting Design Service Department. He joined Philips as a lighting engineer in 1948 and his most recent appointment was that of senior lighting engineer in the company's south-east region.

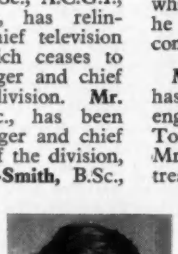
Mr. W. G. Whitaker to be senior lighting engineer in the south-east region. Mr. Whitaker joined the company in 1944 and since 1954 he has been regional lighting engineer in the Midlands.

Mr. R. H. Chambers to be regional lighting engineer, Midlands region. Before joining the Lighting Design Service of Philips in Birmingham in 1956, Mr. Chambers was for a number of years with the Lighting Department of the General Electric Co., Ltd.

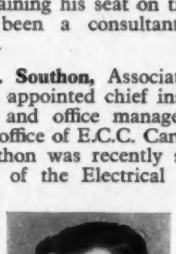
Mr. H. G. Nelson, managing director of the English Electric Co., Ltd., was presented on 30th November with



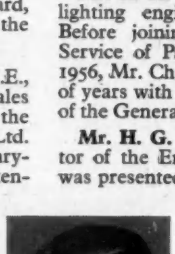
Mr. V. J. Cooper



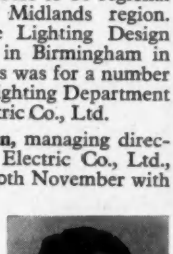
Mr. J. E. H. Brace



Mr. N. N. Parker-Smith



Mr. G. E. Partington



Mr. J. F. James

Mr. H. G. Nelson (left) receiving the Benjamin Franklin Medal from Mr. O. P. Milne

the Benjamin Franklin Medal by Mr. O. P. Milne, chairman of the Council of the Royal Society of Arts. The medal has been awarded to Mr. Nelson for his work in scientific industrial development.

Mr. J. H. W. Morgan has relinquished his office as radio division chief accountant with Siemens Edison Swan, Ltd., on reaching retiring age. He will, however, continue to serve the organisation for a time at 33, Grosvenor Place, London, S.W.1, headquarters of Associated Electrical Industries, Ltd., and will advise on the formation of the A.E.I. Cable Division, which will combine the interests of the cable divisions of Siemens Edison Swan, W. T. Henley's Telegraph Works Co. and Liverpool Cables, Ltd., as part of the A.E.I. reorganisation coming into force on 1st January next.

Mr. Morgan joined the Edison Swan Electric Co. in 1920 and in 1921 became chief cashier. In 1926 he was appointed chief accountant, a position he held for thirty-one years until the company's integration into Siemens Edison Swan. A presentation of a television receiver and a cheque was recently made to him on behalf of his staff and friends by the group managing director of Siemens Edison Swan, Dr. J. N. Aldington. **Mr. J. L. Brooke** succeeds Mr. Morgan as divisional chief accountant.

On 2nd December **Arrow Electric Switches, Ltd.,** entertained some 200 of its customers and friends to a cocktail party held at the Rembrandt Hotel, London, S.W.7. The guests were received by Mr. T. S. Crabtree, managing director, and Mr. B. C. Skinner, sales director, with members of the executive staff and representatives.

Mr. Roy Jenkins, M.P. for Stechford, recently opened the first stage of the new extensions of the **Donovan Electrical Co., Ltd.,** at Northcote Road, Stechford. The extension, which incorporates modern features, including electric floor heating and double glazing, is at present only two storeys high, but the foundations are suitable for five storeys. Before the opening ceremony in the presence of about four hundred employees and a number of visitors, the chairman of the company, Mr. E. Donovan, presented gold watches to six employees who had completed twenty-one years' service with the company.

The apprentice prize-giving ceremony of the **Plessey Co., Ltd.,** Swindon, was held on 27th November at the company's Kembrey Street factory. The ceremony was attended by the Mayor of Swindon, Alderman F. D. Jefford, leading representatives of local industry, headmasters of local schools and parents of the apprentices. Nearly fifty apprentices received prizes and awards from the Mayor, and the apprentice of the year honours board, bearing the name of the best apprentice to complete his training this year, Mr. F. B. Langworthy, was unveiled. Speakers included Sir Thomas Borwick, Mr. R. Hall (management executive) and Mr. A. E. Balchin (training and education officer). Following the ceremony the parents and other guests were shown around sections of the factory.

George E. Taylor & Co. (London), Ltd., announce that **Mr. E. H. Woodhall,** A.M.I.E.E., has been appointed technical director. He received his training with the L.N.E.R. Co., and served in the R.A.F. Airfield Construction Service during the war. Since 1946 Mr. Woodhall has been with the Ministry of Works Engineering Division (New Works) engaged on the construction of atomic energy research and industrial establishments.

Mr. E. H. Woodhall

The ninth annual dinner and dance of the **Exeter Electric Club** was held on 20th November at the Imperial Hotel, Exeter. Over 130 members and friends attended and were received by Mr. A. W. Hicks (president) and Mrs. Hicks. The principal guest, Mr. C. W. Cawte, B.Sc.(Eng.), A.M.I.E.E. (Johnson & Phillips, Ltd.), proposed the toast of the Club, and in reply the president detailed the year's programme. The Bristol Electric Club was represented by the chairman, Mr. G. H. Williams, and Mrs. Williams, and the Plymouth Electric Club by the vice-president, Mr. R. Gates, and Mrs. Gates. The Peters Cup was presented to Mr. K. Gill, winner of the annual treasure hunt, and the Owen Cup presented by the donor, Mr. C. L. Owen, to Mr. N. Payne.

Mr. L. H. Buchanan has been appointed manager of the Glasgow branch of the Simplex Electric Co., Ltd. Mr. Buchanan joined Simplex in 1939 as a sales engineer, and was previously with John Fotheringham, electrical wholesaler, Glasgow. He was educated at Johnstone High School and Paisley Technical College, and was apprenticed to James Kilpatrick & Son, Ltd., with whom he later held a staff appointment. Mr. Buchanan will be responsible to Mr. J. M. Shannon, Scottish area manager.

Mr. L. H. Buchanan

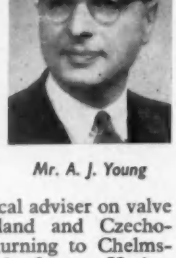
Mr. Sam Black, head of the Publicity Department of the British Electrical and Allied Manufacturers' Association, is resigning his post at the end of this year to take up a new position in publishing. Mr. Black has been associated with B.E.A.M.A. since 1955 and has been very active on its behalf in connection with publicity and exhibitions. He had the main responsibility for organising the British Electrical Industry's outstanding collective exhibit at the Brussels Fair.

Mr. R. G. Kenwright has joined the Plessey Co., Ltd., as chief engineer, Television Components Division, Components Group, Ilford. He was previously chief engineer of Pilot

At the dinner-dance of the Exeter Electric Club. The group includes Mr. A. W. Hicks (president) and Mrs. Hicks, Mr. C. W. Cawte and Mrs. Cawte, Mr. G. Williams (chairman, Bristol Electric Club) and Mrs. Williams, Mr. R. Gates (vice-president, Plymouth Electric Club) and Mrs. Gates

Radio, Ltd. For ten years he was a member of the B.R.E.M.A. Technical Committee and has also served on various technical sub-committees of the Association.

Mr. A. J. Young, B.Sc.(Eng.), M.I.E.E., has been elected to the board and appointed managing director of the English Electric Valve Co., Ltd., and **Mr. F. N. Sutherland**, C.B.E., M.A., M.I.E.E., has also been appointed to the board.

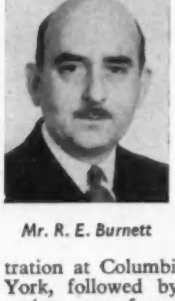


Mr. A. J. Young

Mr. Young began his career in 1934 with Marconi's Wireless Telegraph Co., Ltd., as technical adviser on valve production in Poland and Czechoslovakia before returning to Chelmsford at the outbreak of war. He has been associated with the English Electric Valve Co., Ltd., since its inception and was appointed general manager in 1956.

Mr. F. B. Coales and **Mrs. Coales**, directors of Winn & Coales, Ltd., are leaving London in the s.s. *Iberia* on 16th December for Australia and the Pacific, visiting the Denso agencies. They will return to London on 16th April.

Mr. R. E. Burnett, M.A.(Oxon), A.M.I.E.E., A.Inst.P., general manager of Marconi Instruments, Ltd., has been elected to the board, and appointed managing director. Mr. Burnett graduated at Oxford University in 1937 with an honours degree in physics. In 1955 he studied business management in the department of business administration at Columbia University, New York, followed by a study tour of various manufacturing establishments in the U.S.A. He was appointed general manager of Marconi Instruments in 1956, having previously occupied the position of deputy general manager. Before joining Marconi Instruments, Mr. Burnett was assistant to the general manager of Marconi's Wireless Telegraph Co., Ltd. His appointments with that company included principal of Marconi College and manager of the Education and Technical Personnel Departments.



Mr. R. E. Burnett

The **Telegraph Construction & Maintenance Co., Ltd.**, held its annual dinner at Claridge's on 3rd December when Sir John Dean, chairman of the company, presided. Mr. R. Bevins, Postmaster General, was the principal guest, and proposed the toast of the company to which Sir John Dean replied. Mr. W. H. McFadzean, president of the Federation of British Industries and chairman and managing director of British Insulated Callender's Cables, Ltd., proposed the toast of the guests and the High Commissioner for Canada responded. Among those also present were the High Commissioners for Australia, Malaya, Pakistan, Ceylon, and Rhodesia and Nyasaland, and representatives of Government Departments as well as of the telecommunications, electrical, electronics and plastics industries.

Mr. G. W. Barras and **Mr. A. E. Flatman** have been appointed directors of Arrow Electric Switches, Ltd.

At the recent annual general meeting of the **Electrical Trades' Commercial Travellers' Association** a sum of £650 was allocated to the Electrical Industries Benevolent Association, and a similar amount to the Royal Commercial Travellers' School. These amounts were made up as follows:—£200 to each from the Association, and £450 to each from the Sam Johnson Memorial Fund.

The annual dinner and smoker stag party of the Association was held on 4th December at the Windsor Castle Hotel, Victoria.

For the first time the London Graduate and Student Section of the **Institution of Electrical Engineers**, together with the Graduate and Student Sections of the Institutions of Civil and Mechanical Engineers, are holding a New Year's Eve dinner-dance at Bucklersbury House, London, E.C.4, from 8 p.m. to 3 a.m. Double tickets (£4 10s each) can be obtained from Mr. D. Sheppard, 11, Ranelagh Gardens, Harlesden, N.W.10.

Seven members of the service organisation of **Electrolux, Ltd.**, including the service manager, Mr. Frank C. Reeve, were among the twenty-five employees to receive gifts and certificates after twenty-five years' continuous service, at the company's annual sales celebration dinner and dance held at Grosvenor House, Park Lane, London, on 1st December. The presentations were made by the chairman, Sir Harold Wernher. The dinner-dance followed the annual one-day sales conference which took place at the Café Royal, Regent Street, W.1, and which was attended by the directors and management and about two hundred senior sales staff from the company's fourteen divisional areas.

On 7th December 102 employees who have completed forty years' or more service with **G. & J. Weir, Ltd.**, Glasgow, were presented with inscribed gold watches by the chairman, Viscount Weir, C.B.E. The recipients included the managing director and the works director.

Mr. A. R. M. Tanner has joined the board of Easiclene Porcelain-Enamel (1938), Ltd., as sales director. He has been general manager for the past four years and is succeeded in that position by Mr. P. Winter.

At the annual general meeting of the Junior Institution of Engineers, held on 27th November, **Mr. E. M. Baskerville** was elected chairman.

Mr. R. V. Forward has been appointed deputy manager of the Scotland and Northern Ireland region of the A.E.I. Lamp & Lighting Co., Ltd., and his offices will be at 53, Pitt Street, Glasgow, C.2 (telephone: City 6585). Mr. Forward was previously assistant regional manager of the Scottish region, a post he had held since 1957. He joined the B.T.H. Co. at Glasgow in 1933, and later served in the Royal Air Force for seven years, until 1946. He re-joined B.T.H. as a lamp and lighting representative (lighting section) and was subsequently appointed senior lamp and lighting representative. In 1955 he was appointed assistant regional manager (lamp) of the Scottish region.

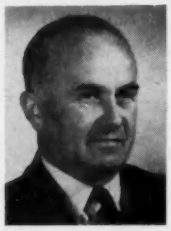
Mr. R. V. Forward

The twenty-ninth annual ball of the **Electrical Industries Benevolent Association** (Tyne and Wear Area) was held at the Old Assembly Rooms, Newcastle-upon-Tyne, on 1st Decem-

At the E.I.B.A. Tyne and Wear Area annual ball. Left to right: Mr. T. M. Ayres, Mrs. Ayres, Mrs. Dellow and Mr. T. E. Dellow

ber, when Mr. T. E. Dellow (chairman) and Mrs. Dellow received the guests who numbered about 350.

Mr. H. Farrington, A.M.I.Mech.E., who writes in this issue on "Gas Turbine Generators," received his technical education at the Manchester College of Technology. He served his apprenticeship with Beyer, Peacock & Co., Ltd., Gorton, and after a period with the North British Locomotive Co., Ltd., Glasgow, he joined the Metropolitan-Vickers Electrical Co., Ltd., as a draughtsman in 1935 and transferred to the Mechanical Engineering Department in the following year. In 1942 he was concerned with design work on early jet engines and joined the Gas Turbine Engineering Department when it was formed in 1944. Mr. Farrington was made section leader in charge of performance and aerodynamic design in 1948 and engineer-in-charge, projects and tenders, in 1956.



Mr. H. Farrington

Mr. Farrington's extra-departmental activities have included membership of the Aerodynamic Sub-Committee of the Gas Turbine Collaboration Committee under the Ministry of Supply from 1948 to 1958, lecturing at the School of Gas Turbine Technology, Farnborough, from 1950 to 1956, and service on several committees of the British Standards Institution and B.E.A.M.A.

The president, Mr. C. Robertson King, presided at the Christmas luncheon of the **Electrical Industries Club** last Tuesday. Over 300 members and guests, a record number, were in attendance, and a collection on behalf of the older beneficiaries of the Electrical Industries Benevolent Association realised the sum of £111 2s. The next meeting will be on Tuesday, 12th January, when the guest speaker will be Lord Verulam.

OBITUARY

Mr. C. R. Bicknell.—The death has occurred of Mr. Claude R. Bicknell, Orpington, Kent, a former Siemens Edison Swan lighting specialist. Mr. Bicknell retired in 1957 after forty-four years' service with the company, which he represented on various technical committees. In addition, he served on a number of B.S.S. code drafting committees and on the E.D.A. street lighting panel. Mr. Bicknell was also an active member of the Illuminating Engineering Society, acting as hon. editor of its *Transactions* for three years, and presenting a number of papers, the most recent one being a joint effort with Mr. J. T. Grundy, also of Siemens Edison Swan, given at the 1957 A.P.L.E. Convention at Torquay. During his last months with Siemens Edison Swan, Mr. Bicknell was attached to the publicity department.

Mr. A. F. Rankin.—The death occurred on 30th November, at his home, following a short illness, of Mr. Andrew Fulton Rankin, who had been associated with the Watford Electric & Manufacturing Co., Ltd., since 1925 and for the past 25 years was the company's Birmingham and South Wales technical sales engineer. He was sixty-one.

Mr. Joseph Poliakoff, who founded the Multitone Electric Co., Ltd., died recently. Mr. Poliakoff was born in Russia in 1873 where he founded the Telephone Construction Co., and he was the patentee of a number of telephone subjects. In 1916 he came to this country and negotiated an agreement with the Marconi Co., which took an interest in the Telephone Construction Co. in Russia. He returned to this country in 1924 and later became naturalised. With Henry Myer, a solicitor, he founded the Multitone Electric Co., Ltd., in 1931 to manufacture inter-valve transformers which he designed, and to develop hearing aid apparatus, especially for schools for deaf-mute children. He was managing director of the company until 1938, when he resigned in favour of his son, Mr. A. Poliakoff, but he continued to serve on the board of directors until his death.

Mr. John Munro, M.I.E.E., director of Murray, Munro & Co., Ltd., electrical contractors, died on 25th November, after a long illness, at the age of seventy-one.

Mr. C. H. Mills, London area manager of Aiton & Co., Ltd., Derby, since 1947, died on 6th December after a short illness. Mr. Mills had been with the company for nearly fifty years. Before his appointment as London area manager, he was in charge of sales in the Manchester area.

Mr. Joseph McKnight, a director of William Coates & Son, Ltd., electrical engineers, Belfast, has died at the age of fifty.

MECHANICAL ENGINEERS' RATES

Appeal Court Decides Against Institution

THE Court of Appeal decided on 1st December that the Institution of Mechanical Engineers was not entitled to exemption from the rating of its premises under Section 1 of the Scientific Societies Act of 1843.

The matter came before the Court on an appeal by the Valuation Officer and the Westminster City Corporation from a decision by the Lands Tribunal last year exempting the Institution from local rates. Under the section referred to exemption is granted to "any land, houses or buildings . . . belonging to any society instituted for the purposes of science, literature, or the fine arts exclusively . . . provided that the society shall be supported wholly or in part by annual voluntary contributions." In its royal charter the objects of the Institution are said to include the promotion of the development of mechanical engineering by encouraging invention and research and to co-operate with universities and other educational institutions and authorities for the furtherance of education in engineering science or practice.

Reading the Court's judgment, Lord Justice Hodson (as reported in *The Times*) said that the first question was whether the Institution was formed for the purposes of science exclusively. There was a science of mechanical engineering but the term included something more than the science of mechanical engineering. Their Lordships were of the opinion that on a proper construction of Clause 7 of its charter the Institution was not formed for the purpose of science exclusively. It might be that science and practice were to some extent interdependent but that did not mean that they were the same thing.

Having decided that the Institution was not formed for the purpose of science exclusively, their Lordships found it unnecessary to consider whether the premises had been used for purposes other than those set out in the charter. There was, however, the further question whether the Institution was supported wholly or in part by annual voluntary contributions. Of the income for the year ended 31st December, 1955, amounting to £168,482, £138,750 was derived from subscriptions. The question was whether they were voluntary contributions.

It did not depend on whether there was any consideration at all for a payment. A nominal consideration might be ignored and that no doubt had led the Tribunal to take a liberal view in some cases. It was true that the Institution had not sought to promote the professional interest of its members, but it could not be said that the subscriptions were in their nature altruistic. Not only were the members entitled to the society's publications, but they also obtained the benefits of a society composed of professional men interested in the same subjects and deriving advantages from their corporate studies. The subscriptions could not be regarded as voluntary within the meaning of that word in the Act of 1843.

On these grounds the appeal would be allowed. Leave was given to the Institution to appeal to the House of Lords.

Financial Section

STOCKS and SHARES

IN most sections of the Stock Exchange the movement of prices has again been irregular. In the industrial market investors have seemed rather more disposed to secure profits than to take on fresh commitments at this season of the year, and conditions were not helped by the development of pronounced weakness in the gilt-edged market: discussion arose there of a rise in Bank Rate to counteract the effect upon sterling of the higher rates ruling in America and elsewhere. Among industrials there has been evidence of more enquiry for investments in the capital equipment industries and a corresponding check to the boom in the category of consumer goods.

Capital Equipment

English Electric shares were again well supported, up to 46s 3d, but there was little change in those of the other major electrical groups. Several heavy engineering shares reflected the revival of interest in capital equipment investments. Simon-Carves at 32s 6d and International Combustion at 38s 9d were both half-a-crown to the good, and there were improvements in Head Wrightson, W. H. Allen and Clarke Chapman. C. A. Parsons at 54s 6d and A. Reyrolle at 94s 6d each added a shilling or so to the previous week's 2s 6d rises. Domestic equipment shares were noticeably quieter: Hoover came back a little to 95s 6d, and losses were shown by such issues as Vactric, Burco and British Vacuum Cleaner. In the cable group, B.I.C.C. at 54s 3d fully retained their recent improvements. Dictograph were again in favour at 11s 3d, but Telephone Manufacturing have been marked down 1s to 6s since the decision to pay no interim dividend for this year.

Decca Results

Decca 10s shares were little altered after publication of the results for the year ended last March, the ordinary being quoted at 45s 3d and the "A" shares at 41s 3d. The dividend remains unchanged in effect (allowing for this year's scrip issue) at a total of 20 per cent, although further increases are announced in turnover to £21·8 million, in the trading balance to £3·3 million and in the net profit after all charges to just over a million, which gives cover of some 1¾ times for the amount distributed in the dividend. Yields are now approximately 4½ per cent on the ordinary and 4¾ per cent on the non-voting "A" shares. Of progress in the current year, which has been running for eight months, the directors say that turnover has again been substantially higher than in the comparable period of the previous year.

Tube Investments Meeting

Among the points which attracted interest in Sir Ivan Stedeford's review accompanying the Tube Investments annual report were his general comment that trading during the year 1958–9 "came in like a lamb and went out like a lion rampant"; his view that although the price paid for the acquisition of

Price Changes in

Company or Board	Nom. Value	Middle price 7th Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1959 Highest	1959 Lowest
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	80	−1	3	3	3 15 0	81	77½
Brit. Elec. 1974/77	100	77	−1	3	3	3 18 0	78	74½
Brit. Elec. 1976/79	100	80½	−½	3½	3½	4 7 0	81	77½
Brit. Elec. 1974/79	100	91	−½	4½	4½	4 13 6	91½	87½
Overseas Electric Supply								
Calcutta Elec.	£1	20/-		6·8†	7†	11 8 0	20/-	16/-
East African Power	£1	20/6	−6d	7½	8	7 16 0	22/6	19/3
Nigerian Elec.	£1	17/-		8	8	9 8 6	18/-	13/-
Perak Hydro-Elec.	£1	14/6		10	5	6 18 0	15/-	12/3
Electrical Shares								
Aberdare Holdings	5/-	17/3		17½	17½	5 1 6	18/9	15/6
Aerialite	1/-	8/3	+3d	54	54	6 11 0	12/3	7/9
Allen, W. H.	£1	56/3	+1/3	11	12	4 5 6	56/3	43/-
Allied Insulators	5/-	23/6		—	20‡	4 5 0	23/6	18/9
Anglo-Portuguese Tel.	£1	29/-		9	9	6 4 3	30/9	26/6
Aron Elec. Ord.	£1	45/-		15	15	6 13 3	62/6	45/-
Assoc. Elec. Ord.	£1	59/6	−6d	15	15	5 0 9	67/-	53/9
Automatic Tel. & El.	£1	81/3		17	17‡	4 3 9	82/6	71/3
Babcock & Wilcox	£1	44/3	+9d	13‡	13	5 17 9	52/6	43/-
Bakelite	10/-	38/9		15	15	3 17 6	40/-	22/-
Baldwin, H. J.	2/-	2/6		20	—	—	3/-	2/-
Berry's Electric	5/-	33/3	+3d	10	20‡*	3 0 3	33/6	7/3
Bowthorpe Holdings	2/-	10/-	−3d	25	27	3 5 0*	10/9	8/-
British Elec. Traction: Def. Ord. "A"	5/-	44/6	−1/-	25	35	3 18 9	47/6	35/6
B.I. Callender's	£1	54/3		12½	13½	4 19 9	58/6	44/9
B.I. Callender's 6% Pref.	£1	21/-		6	6	5 14 3	21/-	19/9
British Thermostat	5/-	22/6		30	35	3 17 9*	28/-	18/6
British Vac. Cleaner	5/-	11/6	−9d	10	7½*	3 5 3	12/6	4/6
Brook Motors	10/-	58/6		25	24½*	4 2 6	59/6	46/-
Bulgin, A. F.	1/-	12/-	+6d	45	50	4 3 3	12/-	6/9
Bulpitts	5/-	19/6	+3d	—	15	3 17 0	19/6	10/-
Burco Dean	5/-	18/6	−1/-	22½	16*	4 6 6	19/6	12/3
Cable & Wireless: Ord.	5/-	17/9	−3d	10	10*	2 16 3	18/6	12/3
4% Loan	100	96		4	4	4 3 3	96	93
Chloride El. Storage "A"	£1	65/6		17½	20‡	4 1 6*	72/-	43/8
Clarke Chapman	£1	55/-	+2/-	27½	13‡*	5 0 0	66/3	52/6
Cole, E. K.	5/-	25/3	+3d	17½	20	3 19 3	25/6	17/3
Contactor Switchgear	5/-	14/9		14	14	4 15 0	16/9	12/-
Cossor, A. C.	5/-	7/3		Nil	5	3 9 0	9/-	6/3
Crabtree	10/-	53/-		20	20	3 15 6	54/-	28/-
Crompton Parkinson	5/-	17/6	+3d	12	14	4 0 0	19/-	11/9
Davis & Timmins	5/-	21/9		18	20	4 12 0	22/-	14/6
De La Rue	10/-	66/6	+1/-	17½	20	3 0 3	66/6	30/3
Decca "A"	10/-	41/3	−1/3	50	20*	4 17 0	44/3	33/3
Desoutter	5/-	33/9	+2/-	25	21‡*	3 4 0	33/9	19/-
Dewhurst	2/-	9/-	−3d	20	20	4 9 0	9/6	7/3
Dictograph Tel.	2/-	11/3	+9d	20	20	3 11 0	11/6	7/-
Dubilier Condenser	1/-	5/3		20	25	4-15 3	5/6	3/3
Duport	5/-	21/9		12½	17½	4 0 6	21/9	10/3
E.M.I.	1C/-	77/-		15	20*	2 12 0	81/-	48/-
Electrical Apparatus	5/-	14/-		14½	14½	5 3 0	16/6	13/-
Electrical Components	5/-	13/3	−6d	12½	15	3 15 6*	14/-	7/-
Elec. Construction	£1	35/-		8½	9	5 2 9	37/-	27/9
Elliott-Automation	5/-	25/6x.r.		—	11·2‡	2 3 9	30/6	16/9
English Electric	£1	46/3	+9d	14	14	4 1 0*	48/9	37/10
English Electric 3½% Pref.	£1	13/6		3½	3½	5 11 0	13/6	12/3
Ericsson Tel.	5/-	25/6		12†	13†	4 3 6	28/-	22/3
Ever Ready	5/-	24/-	−3d	20	27½‡	3 8 6*	28/-	13/3
Falk Stadelmann	£1	35/6	+1/-	10	10	5 12 9	35/6	25/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

British Aluminium was high, it was financed largely out of cash resources and should not impair the earnings cover at all materially in the period before the investment matured; and his references to successful progress in the field of electrical domestic equipment, the range of which is to be extended to include refrigerators. The chairman anticipated satisfactory results for this year, given a maintenance of present trends. The company's £1 shares have risen further to 122s 6d. They show a yield of 3¼ per cent on the basis of a dividend which is being raised from 17½ to 20 per cent and is covered 2¾ times over by the latest profits.

Electrical Investments

Company or Board	Nom. Value	Middle price 7th Dec.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
Electrical Shares—continued						£ s d		
G.E.C.	£1	43/6	−6d	10	10	4 12 0	48/-	31/3
G.E.C. 6½% Pref.	£1	23/-		6½	6½	5 13 0	23/-	20/3
General Cables	5/-	9/-		24	15	8 6 9	9/3	7/6
Greenwood & Batley	£1	116/3		20	20	5 3 3	117/6	75/-
Hackbridge Holdings	5/-	15/9		20	20	6 7 0	19/3	14/3
Hackbridge & Hewittic	5/-	14/3	−3d	20	20	5 5 3*	15/6	10/6
Head Wrightson	5/-	23/-	+6d	20	14‡*	3 0 9	26/-	16/6
Heatrae	2/-	9/6		20	20	4 4 3	10/-	7/6
Holophane	5/-	18/9	−3d	22½	26	6 18 9	20/-	14/9
Hoover	5/-	95/6	−1/3	50	60	3 2 9	98/9	55/-
I.C.I.	£1	54/3	−9d	12	8*	2 19 0	58/9	33/-
Intl. Combustion	5/-	38/9	+2/6	25	30‡	3 17 6	39/-	29/9
Intl. Computers & T.	£1	71/3	−1/3	—	8‡	2 5 0	78/9	57/6
Johnson & Phillips	£1	18/9	−6d	5	5	5 6 9	30/6	18/3
Lancashire Dynamo	£1	47/-	−6d	11	12½‡	3 19 9*	48/9	31/6
Laurence Scott	5/-	18/-		15	15	3 11 6*	18/9	14/-
Lister, R. A.	£1	48/6		10	12½	5 3 0	50/6	32/9
Lucas, J.	£1	65/3		10	12½	3 18 6	70/-	43/3
Marconi Marine	£1	42/-		10	10	4 15 3	48/6	40/-
Marryat & Scott	2/-	12/6		37½	22½*	3 12 0	12/6	8/6
Mather & Platt	£1	50/-		15	10‡*	4 5 6	51/6	41/3
Metal Industries	£1	70/-	+1/3	14	15‡	4 5 9	71/3	39/9
Midland Elec. Mfg.	£1	50/-	+1/3	12½	10*	4 0 0	50/-	41/6
Morphy-Richards	4/-	32/6		20	25	3 1 6	34/-	18/-
Murex	£1	62/6	−1/3	17½	15	4 16 0	63/9	42/-
Newman Ind.	2/-	3/6		10	10	5 14 3	3/6	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/3	2/6
Parsons, C. A.	£1	54/6	+1/6	7½	8½‡	2 19 6	58/-	45/9
Philips' Lamps	Fl.10	142/6	+3/9	14	14	1 17 0	142/6	88/-
Plessey	10/-	42/6		20	13*	3 1 3	46/3	23/6
Pye	5/-	20/6	−3d	12½	12½	3 1 0	22/6	13/9
Pyrotenax	5/-	44/9	−2/3	—	34	3 16 0	47/6	33/9
Reliance Clifton	5/-	22/6		15	15	3 6 9	24/6	17/6
Reyrolle	£1	94/6	+1/3	17½	17½	3 14 0	98/-	85/9
Rheostatic	4/-	13/3	+9d	12½	12½	3 15 6	13/3	8/3
Richardsons Westgarth	10/-	11/6		8½	8½	7 5 0	15/3	11/6
Simon-Carves	5/-	32/6	+2/6	25	25	3 17 0	32/6	28/6
Smith (England), S.	4/-	18/-	−3d	12½	17½	3 17 9	21/-	11/6
Southern Areas	£1	14/6		Nil	Nil	Nil	15/-	10/6
Strand Elec.	5/-	17/9		15	20	5 12 9	18/-	8/6
Sturtevant	5/-	22/6		15†	15†	5 9 0	23/6	17/-
Sun Elec.	5/-	16/-		25	15*	4 13 9	16/9	8/3
Switchgear & Cowans	5/-	15/6		22½	15*	4 16 9	16/-	10/3
T.C.C.	10/-	57/6		25	25	4 7 0	58/6	38/-
Telephone Mfg.	5/-	6/-	−1/-	10	10	8 3 6	7/3	4/9
Telephone Rentals	5/-	19/-	−6d	12½	12½*	3 5 9	22/6	11/9
Thompson (John)	5/-	20/9	+9d	25	25	6 0 6	25/6	19/6
Thorn Elec.	5/-	48/9		17½	20	2 1 0	50/-	26/3
Thornycroft	£1	22/3	+1/-	7½	6	5 7 9	30/-	20/6
Tube Investments	£1	122/6	+2/6	17½	20	3 5 3	122/6	71/6
Vactric	5/-	40/3	−2/3	25	37½	4 13 3	46/6	26/3
Veritys	5/-	1/6		12½	3½	—	5/-	1/3
Walsall Conduits	4/-	14/9		22½	22½	3 9 3*	15/3	10/8
Ward & Goldstone	5/-	55/6	−1/-	25	30	2 14 0	57/6	30/6
Watford	2/-	11/6	−6d	25	25*	4 7 0	14/9	7/6
Westinghouse	£1	50/-	−6d	10	10	4 0 0	53/9	39/6
West, Allen	5/-	13/9	−6d	12½	11‡*	4 5 0	14/6	11/9
Wolf Electric	5/-	9/6	+3d	10	10	5 5 3	9/9	7/9

Elliott-Automation Issue

Dealings began this week in new Elliott-Automation 5s shares, which are offered to existing shareholders at 20s, on a one-for-five basis. Early transactions were at a premium of 5s 6d on the issue price. It is the intention to follow this next February with a scrip issue in the same proportion, applicable to both old and new shares, and to distribute in June a final dividend of 6 per cent on the increased capital. With the interim dividend already paid, this would give a total equivalent to 11·2 per cent on the present capital (or 9·3 per cent after the increase), on which basis the prospective yield on the new shares at an all-in price of 25s 6d (free of stamp duty) would be just under 2¼ per cent. Proceeds of the cash issue will amount to about £2¼ million, to be used partly in repaying temporary loans and partly for general purposes.

Metal Industries Progress

In their half-yearly progress report, Metal Industries disclose a considerable improvement in income and the directors forecast (subject to a continuance of present trends) an increase in the dividend from a total of 14 to 15 per cent. This would raise the yield on the £1 shares, which were marked up to 70s, to 4¼ per cent. Meanwhile the interim payment is being put up from 4 to 6 per cent in order to reduce the disparity between this and the final payment. This year's figures include income from two of the group's latest acquisitions, Towler Bros. and Avo, Ltd. (with its subsidiary Taylor Electrical Instruments), so that there is no strict comparison with the corresponding six months of 1958, but the extent of the expansion from £679,000 to £850,000 (before tax) made a good impression in the market.

British Electric Resistance

The 2s shares of the British Electric Resistance Company have been quoted at around 6s since the publication of the report for the year ended 31st July. Trading profits in this period were almost up to the record figure for the previous year, and with an increase in the net surplus after tax, there was ample accommodation for the raising of the dividend from the equivalent of 13¼ (allowing for a subsequent scrip issue) to 15 per cent. The shares offer a yield of 5 per cent on a dividend covered more than twice over by earnings.

Radio Show, 1960

Next year's National Radio and Television Exhibition will be held at Earls Court, London, from 24th August to 3rd September with a preview for overseas and other specially invited visitors on 23rd August.

REPORTS and DIVIDENDS

Tube Investments, Ltd. — The annual meeting will be held on 14th December. In his statement which has been circulated to stockholders, Sir Ivan A. R. Stedeford (chairman) says that the most notable event of the year under review was the passing of the control of the British Aluminium Co., Ltd., into their hands. Since the end of the financial year they have agreed to acquire, for about £5 million, the whole of the aluminium foil business of Venesta, Ltd. The acquisition will be made by Reynolds T.I. Aluminium, Ltd., and the business will be operated by a new subsidiary of that company to be formed —British Aluminium Foils, Ltd.

Speaking on the need for development spending, Sir Ivan says that T.I.'s capital expenditure continued at a steady but reduced rate, to meet the official policy of restraint. The Common Market in Europe presents Britain with a serious challenge which will grow stronger with the years. They welcome the initiation of the Outer Seven Market, but few now can feel very optimistic about the prospects of creating a Free Trade Area over the whole of Western Europe, including this country. The chances are that in a few years we shall be faced across the Channel by an integrated system of great industrial resources, enjoying the economic benefits of large-scale production, and attacking world markets with the strength of a huge protected home market behind it. If Britain is to continue to be prosperous in a world of great industrial power blocs, we must raise our industrial efficiency far beyond anything we have yet achieved or attempted. In the next decade capital expenditure should be given as high a national priority as was once given to exports and housing.

Throughout the year export markets continued to be difficult and it was encouraging that an increase was achieved in sales to European countries; but their largest markets were again Canada and the United States, with the Eastern bloc moving up to third place. By a higher degree of co-ordination among the plants of a number of subsidiaries, they were able to accept a number of large export orders for precision tubes, against the keenest world competition. The largest of these, valued at over £3 million, came from Russia.

Demands on the domestic appliance industry responded briskly to the thaw in the official attitude to consumer spending and the fruits of much development and marketing effort by the Simplex Electric Co., Ltd., were able to be harvested in good measure. It was another record for this division. The "Creda" range of electric cookers has earned a popularity second to none, and this the new "Mercury Four" promises to enhance; the "Debonair" spin dryer also maintained a lion's share of a rapidly widening market. The same "Creda" design team introduced a new domestic appliance, the Creda "Corvette," which provides quickly, warm, hot or boiling water "on tap" at the kitchen sink. It is their intention next season to enter the domestic refrigerator market. The easing of restrictions was slower to react on the industrial side of the division. Over-capacity in the cable industry as a whole, and a chaotic price situation have resulted in a disappointing year for Mersey Cable Works, Ltd., and the slow revival of industrial building has not yet enabled the Power Centre Co. to take advantage of its new production facilities at Wednesbury. While there is no strong evidence of a return to robust conditions in the industrial capital field, the trend of current business is upwards.

The steel tube companies were considerably affected by the recession. Orders were slow to revive, and the prolonged lull took its toll of the division's earnings. Their hopes for the current year are firmly based on full order books.

The present surge in consumer demand has not coincided with a similar one for capital goods. The experience of their companies engaged in the capital goods industry has closely conformed to this national pattern; nevertheless,' a number increased their turnover, if at lower margins. Earnings suffered accordingly. Sir Ivan also refers to the activities of the other divisions and to the group's overseas activities.

Metal Industries, Ltd.—The half-yearly report to 17th October last shows group profits of £850,000, as compared with £679,000 for the corresponding period of 1958. The estimated taxation is £414,000 and the net balance is £436,000 (against £323,000). The directors forecast, if present trends continue, an increase from 14 per cent to 15 per cent in the total dividend for the year. To reduce the disparity between the interim and final dividends, the interim dividend is raised from 4 per cent to 6 per cent. Sir Charles Westlake, in a statement to holders, says that this year Towler Brothers (Patents), which joined the group in September, 1958, and Avo, Ltd., and Taylor Electrical Instruments, which joined the group in April last, have been included. The earnings of these companies have justified their forecasts.

Aerialite, Ltd.—The annual meeting was held on 2nd December, Mr. L. S. Hargreaves (chairman and managing director) presiding. In his review of the year, which had been previously circulated, Mr. Hargreaves said that in spite of considerable difficulties in the cable industry, the net profit earned was almost the same as it was last year. Referring to the price war and under-cost selling which was now prevalent in the industry, he said that they were fortunate in that they had diversified their operations sufficiently to be able to say that in spite of the troubles in the cable industry their business still remained profitable. But the effect of the price war on the cable factory was quite serious and was being substantially felt. By economy and effort they had remained profitable in their cable operation due to special cables on which they had patents, and increased sales of certain cables, which were not largely made by competitors. The "bread-and-butter" cables, however, were being sold by competitors at a loss and this was affecting the whole of the cable industry at the present time.

They looked forward to a better situation in the cable industry; perhaps less greed and more conscience, or even belated Government action to stop the prostitution of free enterprise which was now being allowed to develop in one industry after another. These operations were a greater danger to shareholders and consumers than nationalisation ever was.

Turner & Newall, Ltd., report a group trading profit for the year to 30th September last of £11,898,707, as compared with £11,727,116 for 1957-58, to which is added miscellaneous income of £1,105,157, making £13,003,864. Taxation absorbs £6,108,939, and the net profit is £6,894,925 (against £5,973,524). General reserve receives £2,000,000 and it is proposed to pay a final dividend of 15 per cent (against 10 per cent), making 20 per cent (15 per cent) for the year. The balance carried forward is £1,939,125 (against £671,209 brought in).

Dimplex, Ltd.—An offer for sale of 300,000 ordinary shares of 5s each has been arranged by the Minster Trust on behalf of the company. Application is being made to the Stock Exchange for the quotation of the whole of the ordinary capital—1,000,000 shares.

Camp Bird, Ltd.—Subject to final audit, the consolidated net profit for the year to 30th April last is £319,076, after taxation of £347,633. This compares with a net profit of £323,890 for the previous year. It is proposed to pay a final dividend of 10 per cent on capital increased by acquisitions, making 20 per cent for the year (unchanged).

Hick, Hargreaves & Co., Ltd., have declared an interim dividend of 4 per cent (unchanged).

Telephone Rentals, Ltd., has announced an interim dividend of 5 per cent (against an equivalent of

(*Continued on page 857*)

FINANCIAL SECTION *(continued)*

4½ per cent after allowing for a scrip issue).

Belliss & Morcom, Ltd., are paying an interim dividend of 3 per cent (against 4 per cent).

New Companies

British General Electric Co. of Japan, Ltd.—Registered 24th November. Capital £10,000. Electrical, electronic, nuclear, mechanical, constructional, civil and general engineers, etc. Directors: A. L. G. Lindley and R. N. Millar (directors of General Electric Co., Ltd.), R. J. Smith, Japan, Dr. K. J. Wootton (manager, Atomic Energy Division General Electric Co., Ltd.), and D. G. W. Acworth (director of General Electric Co., Ltd.). Regd. office: Magnet House, Kingsway, W.C.2.

D. & E. S. (Holdings), Ltd.—Registered 12th November. Capital £100. Manufacturers and dealers of dynamos, magnetos, armature, motors, radiators, batteries, contacts, insulators and insulating materials, electrical plant, etc. Solicitors: John Taylor & Co., 2, Barton Square, Manchester, 2.

Dalbukirk (Street Furniture), Ltd.—Registered 11th November. Capital £5,000. Manufacturers, suppliers, and installation contractors and consultants for lighting columns and other street furniture, etc. Directors: L. P. d'Albuquerque, Barbara E. Naden and S. P. Thmas. Regd. office: 5, St. Philip's Place, Birmingham.

Klippon Electricals, Ltd.—Registered 10th November. Capital £10,000. Designers, manufacturers of and dealers in electrical terminals, connectors, etc. Directors: Commander John C. Webber, R.N. (Retired) and W. E. Fox. Regd. office: 14, Red Lion Square, W.C.1.

Fairline Electrical Products, Ltd.—Registered 4th November. Capital £10,000. Designers, manufacturers of and dealers in vacuum cleaners, and electrical appliances, domestic equipment, etc. Directors: E. Mee and C. F. Capper. Regd. office: 43, Stoke Road, Shelton, Stoke-on-Trent.

Martin (Canterbury), Ltd.—Registered 2nd November. Capital £1,500. To acquire the business of an electrical engineer and contractor carried on by F. G. Martin at Canterbury, as F. G. Martin & Son, etc. Directors: F. G. Martin and E. J. Martin. Regd. office: 34, Northgate Street, Canterbury, Kent.

D.I.D., Ltd.—Registered 3rd November. Capital £100. Manufacturers and hirers of and dealers in electrical goods, etc. Directors: J. M. H. Dunn, W. N. Isherwood and K. R. Dunn. Regd. office: 93, Westgate Road, Wakefield, Yorks.

Thermoduct, Ltd. — Registered 10th November. Capital £500. Electrical contractors, heating and ventilating engineers, etc. Directors: W. T. Sanderson and Esther Sanderson. Regd. office: Viaduct Works, Kirkstall Road, Leeds, 4.

G.B.M. Electrical (Birmingham), Ltd.—Registered 17th November. Capital £5,000. Manufacturers of and dealers in electrical goods of all kinds, etc. Directors: L. Brown and Millie Brown. Regd. office: 439, Moseley Road, Birmingham, 12.

Henfrey Electrical Installations, Ltd.—Registered 17th November. Capital £3,000. Directors: V. B. Freedman and Mrs. Iris S. Freedman. Solicitors: Bulcraig & Davis, Amberley House, Norfolk Street, W.C.2.

Norcott Electrical, Ltd.—Registered 17th November. Capital £100. Electrical engineers and contractors, etc. Directors: P. J. Enticott and Margaret A. Enticott. Regd. office: 5, Mead Road, Dartford, Kent.

Barrow & Gallagher, Ltd.—Registered 20th November. Capital £1,000. Electrical engineers, etc. Directors: W. Barrow and P. P. Gallagher. Solicitors: Rawstron & Hayes, Manchester.

Palladium Electrics, Ltd.—Registered 18th November. Capital £100. Manufacturers' agents, electrical engineers, general electrical installation contractors, radio and television engineers, etc. Directors: B. H. Hyams and B. H. Clarke. Regd. office: 10, Ganton Street, Regent Street, W.1.

Foden Electrical & Engineering Service, Ltd.—Registered 24th November. Capital £1,000. Electrical, mechanical, chemical, heating, ventilating, refrigerating, radio and telegraph engineers, etc. Directors: K. J. Foden and Mrs. Francis D. Foden. Regd. office: 178, Bromsgrove Street, Birmingham, 5.

Electrical Services (Wolverhampton), Ltd.—Registered 23rd November. Capital £1,000. Manufacturers of and dealers in electrical apparatus, etc. Solicitor: David Stephenson, Brierley Hill.

Bede Electrical Services, Ltd.—Registered 24th November. Capital £1,000. Electrical equipment specialists, etc. Directors: T. P. Collins and Mrs. Vera L. Collins. Regd. office: 93, Marsden Lane, South Shields.

Bankruptcies

P. McCarthy, trading as Parmac Electrics, lately residing and carrying on business at 74, Gillygate, York, electrical retailer.—Receiving order made 26th November on a creditor's petition. Public examination 21st January at the Law Courts, Clifford Street, York.

H. W. Daldry, lately carrying on business at 168, Bells Road, Gorleston-on-Sea, Suffolk, electrician.—Further supplemental dividend of 3¾d in the £, payable at the Official Receiver's Office, Norfolk House, Exchange Street, Norwich.

S. Ross, a partner in the firm of Jif Electrical Appliances, 1, Clevedon Street, Stoke Newington, London, N.16, electrical dealer, and lately carrying on business at 98, Mathias Road, Stoke Newington, N.16.—First meeting 17th December and public examination 29th January, both at Bankruptcy Buildings, Carey Street, London, W.C.2.

W. Leeming, formerly carrying on business at 32, Hayfield Road, Salford, and lately carrying on business at 287, Broad Street, Salford, under the style of Leeming Electrics, as an electrical goods retailer.—Trustee, Mr. W. H. Meredith, 20, Byrom Street, Manchester, 3, Official Receiver, released 25th November.

S. Green, 373, Bolton Road, Darwen, Lancs., electrical contractor.—Receiving order dated 21st May, 1951, rescinded and adjudication order dated 21st May, 1951, annulled on 26th November, all debts in bankruptcy having been paid in full together with all fees, costs and charges of the proceedings.

E. Burgess, carrying on business under the style of E. Willis & Co., at 92, Cleveland Street, Doncaster, and formerly residing and carrying on business at 1, Town Moor Avenue, Doncaster, electric organ, television and electrical dealer.—Trustee, Mr. P. Cardwell, 93, Queen Street, Sheffield, 1, Official Receiver, appointed 23rd November.

N. G. Morgan, 28, Major Road, Canton, Cardiff, electrician.—Last day for receiving proofs for dividend 11th December. Trustee, Mr. W. H. Meredith, Official Receiver, County Court Buildings (First Floor), Westgate Street, Cardiff.

L. C. Sampson and **E. C. Tubb**, trading in co-partnership under the style of Electro Radio Stores, at Fore Street, Gunnislake, Cornwall, electrical and television dealers.—Last day for receiving proofs for dividend 11th December. Trustee, Mr. H. Evans, 2, Serjeants' Inn, London, E.C.4.

CATALOGUES AND LISTS

CLUTCHES.—Leaflets dealing with multi-disc electromagnetic clutches and induction clutches.—**Brookhirst Igranic, Ltd.**, Bedford Works, Bedford.

CONDUITS.—87-page booklet (16) describing the company's range of products, including pitch fibre cable conduits and fittings.—**U.A.M. Group of Companies**, Tolpits, Watford, Hertfordshire.

DOMESTIC APPLIANCES. — Leaflet detailing a range of domestic electrical appliances suitable as Christmas gifts.—**Edmundsons Electrical Wholesalers, Ltd.**, 240-250, Ferndale Road, London, S.W.9.

DUST COLLECTORS. — Illustrated brochure (81) describing the Holmes-Rothemuhle multi-cell cyclone dust collectors.—**W. C. Holmes & Co., Ltd.**, Turnbridge, Huddersfield.

ELECTRIC BLANKETS.—Leaflet giving particulars and prices of "Isoblankets."—**Isopad, Ltd.**, Barnet By-Pass, Boreham Wood, Herts.

INSTRUMENTS. — 12-page catalogue dealing with air-operated and electric contact humidity controls.—**Negretti & Zambra, Ltd.**, 122, Regent Street, London, W.1.

LABELS.—Descriptive leaflet giving particulars of the "Dymo-Mite" device for embossing white letters on coloured plastic tapes which will adhere to most surfaces and are suitable for labelling controls and instruments on switchboards, circuit-breakers, etc.—**Hellermann, Ltd.**, Gatwick Road, Crawley, Sussex.

LABORATORY MACHINERY.—20-page catalogue (9606) illustrating and describing a range of laboratory machinery, including crushers, grinders, mills, vibrating screens, etc.—**Sturtevant Engineering Co., Ltd.**, Southern House, Cannon Street, London, E.C.4.

LAMPS.—28-page price list (AL.226) covering the range of "Mazda" lamps.—**A.E.I. Lamp & Lighting Co., Ltd.**, Melton Road, Leicester.

MOTOR CONTROL GEAR.—8-page booklet (154) describing the "Asmag" automatic control system for N-S variable speed a.c. motors.—**Laurence, Scott & Electromotors, Ltd.**, Gothic Works, Norwich.

PLASTICS.—20-page illustrated catalogue dealing with the properties of "Rigidex" polyethylene and illustrating the use of this material in various industries, including applications for cable insulation and sheathing.—**British Resin Products, Ltd.**, Devonshire House, Piccadilly, London, W.1.

PRECIPITATORS.—Two leaflets describing precipitators and blast furnace electro-filters.—**Lodge-Cottrell, Ltd.**, George Street, Parade, Birmingham, 3.

RESISTORS.—Illustrated pamphlet dealing with the "F.P. Hi-Temp" strip resistors for traction, industrial and marine applications.—**Fawcett Preston & Co., Ltd.**, Bromborough, Cheshire.

SPACE HEATING.—Four leaflets dealing with under-floor heating equipment and low and high temperature radiant heating systems, including night storage types.—**Thermodare (Great Britain)**, 94/98, Petty France, London, S.W.1.

Leaflet illustrating and describing under-carpet heaters.—**Isopad, Ltd.**, Barnet By-Pass, Boreham Wood, Herts.

SUN LAMP.—Brochure dealing with the "Super Actinea 59" portable sun lamp.—**Perihel, Ltd.**, 146, New Cavendish Street, London, W.1.

TERMINALS.—Catalogue describing and illustrating "Quick-Fix" terminals covering a range of 20-300 A and mounting and marking components for these terminals.—**Earltram, Ltd.**, 34, South Molton Street, London, W.1.

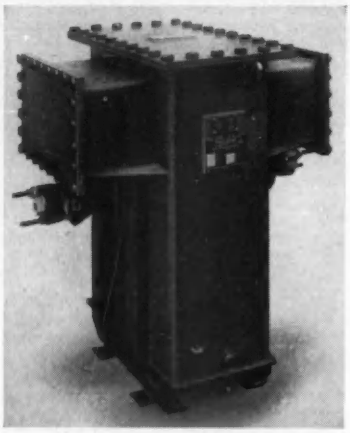
Leaflet (65) showing examples of terminal boxes produced by the company.—**Astral Switchgear, Ltd.**, Enfield, Middlesex.

Leaflet describing a new range of terminal lugs, connectors and clamps suitable for use on transformers, traction equipment and switchgear, etc.—**D. J. Equipment (Hersham), Ltd.**, 43, Queens Road, Hersham, Surrey.

NEW ELECTRICAL EQUIPMENT

Flameproof Mining Transformers

The range of flameproof mining transformers manufactured by ASSOCIATED ELECTRICAL INDUSTRIES, LTD., Mosley Road Works, Trafford Park, Manchester, 17, has recently been extended by the introduction of additional distribution units up to 20 kVA, three-phase, in the 3·3 kV class. These are covered by Ministry of Power flameproof certificates Nos. 4342 and 4343 for groups 1 and 2 gases



A.E.I. 20 kVA flameproof mining transformer

respectively. The range now covers lighting units up to 1 kVA, 3·3 kV, distribution units up to 20 kVA, 3·3 kV, and mobile units up to 500 kVA, 11 kV.

Lift Equipment Suppressors

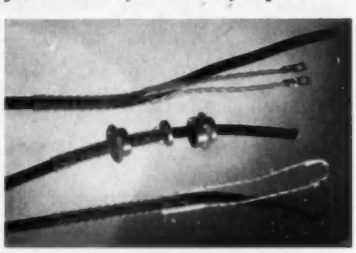
Inductance type suppressors to limit radio interference from electric lifts have been introduced by the PLESSEY CO., LTD., Ilford, Essex. Sparking occurring at the relays and contactors in a lift installation, including gate release and floor trip mechanisms and interfloor calling devices, may cause radio interference by radiation from the wiring or metalwork associated with the lift shaft or by direct injection into the mains. The inductance suppressors have a self-resonance in the centre of the frequency band in which the interference occurs, presenting a high impedance to those currents causing the interference. The suppressors, which are connected in series with the relay contacts, are available with current ratings between ½ and 3 A.

Accelerometer

The type MV 300 accelerometer introduced by DE HAVILLAND PROPELLERS, LTD., Hatfield Aerodrome, Hatfield, Hertfordshire, has a high sensitivity—25 V full-scale output. Models are available with sensitivities ranging from 0·5 to 8 V per g when working into a 0·5 MΩ load, with natural frequencies from 137 to 34 c/s. The seismic mass of the instrument is a laminated armature which forms the moving part of a differential transformer a.c. pick-off. The armature is supported by a leaf spring system, which ensures rectilinear motion for the centre of gravity and virtually eliminates cross coupling errors and the effects of transverse accelerations. The overall hysteresis is less than 0·7 per cent of the amplitude and cross coupling errors are less than 0·2 per cent. Stops capable of withstanding very high shock loads and sustained overloads of the order of 100 g are fitted. An internally mounted demodulator and filter unit, potted in epoxide resin, provides a d.c. output voltage with low ripple content. The accelerometers, which have a three-point mounting, are intended for use between −60°C and +100°C and the temperature coefficient of sensitivity is less than 0·02 per cent °C. Provision is made for the adjustment of both zero error and sensitivity externally by changing the values of miniature resistors.

Cable Suspension Unit

A suspension device suitable for power cables announced by the WORCESTER FABRICATIONS CO., St. John's Works, Worcester, is produced



Worcester Fabrications cable suspension units

Right: Brown Brothers "Balmoral" vacuum cleaner with accessories

from plaited nylon. It can be slipped over the cable and, once installed, withstands a strain of up to 650 lb. The units are supplied with a choice of three terminations to offer a variety of anchoring methods. They are unaffected by oil and being non-magnetic are suitable for use with v.h.f. equipment. A range of sizes from 0·29 to 1·7in diameter are available, priced between 14s 6d and 17s 9d each.

Continuous Weigher

An electronic weigher which is capable of automatically and continuously measuring the flow of materials on a conveyor at a rate between 20 and 20,000 tons per hour is announced by ELECTROWEIGHERS (BIRMINGHAM), LTD., Moseley Street, Birmingham, 12. A dustproof load cell is incorporated in a single idler weighbridge and the weight of the burden on the belt creates pressure on the cell. This is electrically connected to a stable oscillator which—dependent on the load—induces an unbalanced voltage and this voltage, when amplified, is used to give direct readings of the momentary load. An additional voltage from a tacho-generator, driven on the return belt, is multiplied and integrated with the oscillator voltage. The resultant sum, the total burden conveyed, is indicated by counters. The weighbridge is fitted between conveyor stringers and can be remotely connected up to 100 yards from the dustproof electronic control unit. Additional remote recording or indicator instruments can be supplied.

All-Purpose Vacuum Cleaner

The "Balmoral" all-purpose model is the latest to be added to the range of "Duco" vacuum cleaners marketed by BROWN BROTHERS, LTD., Great Eastern Street, London, E.C.2. A cylindrical machine, it is attractively finished in cream with brown end covers, with accessories and flexible hose in matching grey. It is provided with a double insulated a.c./d.c. motor

(200/220 and 230/250 V) and is suppressed for radio and TV. The price of the cleaner, with 15ft of twin flexible and disposable dust bags, is £13 13s, including purchase tax in the United Kingdom.

Power Supply Sub-Units

Designed specifically for continuous duty pulse loading applications, the range of chokeless power supply sub-units announced by the SOLARTRON ELECTRONIC GROUP, LTD., 45, Thames

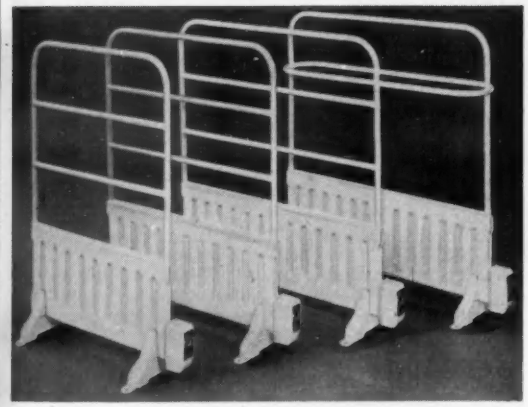
Street, Kingston, Surrey, can withstand pulsing from zero to full load without loss of control. This has been achieved by using circuitry which maintains a stability factor of better than 400 to 1 and enables the very low source impedance to be held up to a frequency of 0·5 Mc/s. The range comprises three sub-units of 100 and three of 200 mA maximum load capacity with output voltages from 100 to 400 V. The output can be varied over ±50 V from nominal, also

Solartron power supply sub-unit

reactive loads may be applied, without affecting the specified performance.

Hurseal "Towel-Rads"

The range of "Towel-Rads"—oil-filled radiators plus heated towel rails—manufactured by HURSEAL, LTD., 229, Regent Street, London, W.1, has been increased to include four more models. The lower section of each model is an 11in high panel radiator which has sufficient heating surface to



The new range of Hurseal "Towel-Rads"

warm an average bathroom or kitchen. The towel rails are an integral part of the complete unit and are heated by the same oil. They are supplied either with detachable feet or with brackets for wall mounting and the overall height of each model is 36in.

Models TRC.2 and TRC.3 have a loading of 350 W and measure 33in and 26in in length respectively. Models TRC.1 and TRC.4 (a special larger capacity model) are both rated at 500 W and are 40in in length. The prices, including purchase tax, are £16 19s 11d (TRC.2 and TRC.3); £18 9s 11d (TRC.1); and £22 19s 11d (TRC.4).

Magnetic Amplifier

A hermetically sealed high power gain magnetic amplifier for use with size 18 servo-motors has been introduced by R. B. PULLIN & CO., LTD., Phœnix Works, Great West Road, Brentford, Middlesex. A polarity reversible d.c. input signal is needed, which is amplified, providing a phase-reversible a.c. output signal to the control phase of the servo-motor. The output voltage is in quadrature with the excitation to the magnetic amplifier. The units are suitable for operation from a 115 V 400 c/s supply and have an output into the rated load of 18 W at 115 V. Each control coil has a resistance of 5,600 Ω and 0·1 μF control coil by-pass capacitors are recommended. Amplifiers are available to operate in temperatures between −55 and +71 or +125°C.

Mains Coupler

A means of connecting two- or three-core bare-ended flexible leads to the mains is provided in the "Safe-bloc" introduced by RENDAR INSTRUMENTS, LTD., Victoria Road, Burgess Hill, Sussex. The base and lid of the block are moulded in thermo-setting plastic insulating material. With the lid closed all live items are inaccessible and as the lid is raised the supply is disconnected from all exposed metallic parts. The live line is supplied with

Rendar Instruments mains coupling block

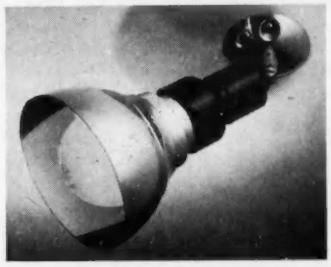
a 5 A fuse as standard but any fuse up to a maximum rating of 13 A can be inserted as required. The terminals are nickel-plated, corrosion-resisting clips with colour-coding and marked L, N and E. The overall size of the block is 5in long by 2⅜in wide by 2in high.

Acid Fume Removal

In the acid fume removal process developed by CHEMICAL CONSTRUCTION (G.B.), LTD., to extract sulphur dioxide from power station and sulphuric acid plant stacks and to recover the sulphur salts for use in the production of fertiliser, ammonia gas is introduced into the flue gases between the economiser and the air heater. The ammonia reacts in the gaseous phase with the sulphur oxides produced by combustion from the sulphur contained in the fuel, and the solid salts produced are removed as a powder from the gas stream in the high voltage electrostatic precipitators installed at most power stations. The residue extracted by this process is a mixture of ammonium-sulphur salts and fly ash, and when separated from the ash the salts form the basis for the production of ammonium-sulphate fertiliser.

Display Lighting Fitting

A reflector, designed to convert a standard tungsten lamp into an efficient display lighting fitting, is now available from the STEARN ELECTRIC CO., LTD., 31, Vauxhall Bridge Road,



Stearn display lighting fitting

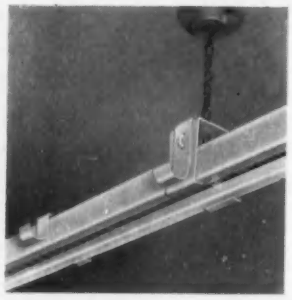
London, S.W.1. It is a highly polished anodised aluminium reflector which clips on to the neck of a 100 or 150 W pearl bulb and produces a concentrated beam of light. Focal adjustment is achieved by moving the reflector up or down the neck of the lamp.

Adjustable lampholder units are also introduced. These consist of a heavy brass backplate and swivel joint, finished in coinage bronze. Both b.c. and e.s. versions are obtainable, the latter being fitted with a bakelite skirted lampholder. They are fully adjustable in any direction.

The prices are:—Reflector (SP1/150), 12s 6d; e.s. lampholder unit (SP1/ES), 13s 6d; and b.c. lampholder unit (SP1/BC), 11s 6d.

Universal Lighting Trunking

The universal trunking system for carrying overhead lighting, electrical fittings, cables and conduits introduced by SIEMENS EDISON SWAN, LTD., 155, Charing Cross Road, London, W.C.2, is based on a lightweight rigid steel channel section incorporating twin unobstructed cable troughs. "Liteline" trunking is available in 15ft lengths, bonderised and grey stove enamelled. The trunking dimensions are 2⅜in wide by 1⅛in deep



Siemens Edison Swan "Liteline" trunking

and the internal channels provide room for cabling with up to 7/·064 conductors. The fittings and accessories available include a terminal connector which enables tappings to be made at any point without stripping the conductor insulation or using terminal blocks, clip-on covers and a range of junction pieces with cover plates. Slide-in coupling pieces locked by four screws ensure a rigid jointing with earth continuity and fittings with B.S.I. or up to ¾in conduit hole fixing can be suspended from any point by a T-bolt assembly. Fuse terminal boxes rated for 5 to 15 A or 60 A give independent fusing of the trunking section, isolation of branch services or ring main facilities.

Brake Motor Range Extended

The range of electric motors incorporating a disc type electromagnetic brake as an integral design feature, announced earlier in the year by NEWMAN INDUSTRIES, LTD., Yate, Bristol, and described in the issue of *Electrical Review* dated 24th April, has been extended to units up to 40 h.p. at 3,000 r.p.m. The brakes incorporated are suitable for building into any Newman f.h.p. and industrial drip-proof or totally enclosed three-phase motor up to 40 h.p. but may not be used for single-phase operation. A torque range from 3 to 120 lb-ft will eventually be covered.

Griddle-Hotplate

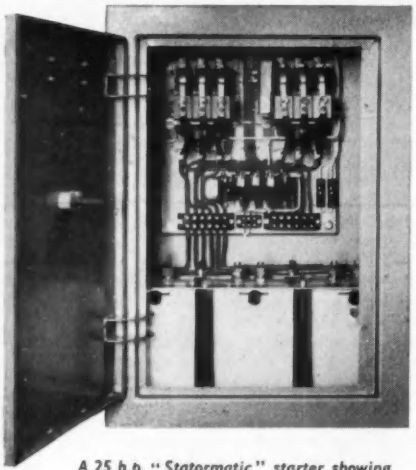
The latest addition to the range of "Presto" automatic electric cooking appliances manufactured by the NATIONAL PRESSURE COOKER CO., LTD., Fort Works, Pelham Street, Wolverhampton, is a griddle-hotplate, suitable for grilling, dry frying and griddle cooking. It can also be employed to keep meals hot or warm plates. Designed to be used on the table, it is operated by a "Control Master" variable heat control unit that automatically maintains the temperature selected. This unit contains a thermostat, pilot light and heat settings and may be used interchangeably for other "Presto" appliances.

The griddle-hotplate has a loading of 1,500 W and measures 17½in by 10in. It is provided with a metal vented lid and the price is £9 13s. The price of the "Control Master" is £2 6s 6d.

"Presto" griddle-hotplate (National Pressure Cooker Co.)

SQUIRREL-CAGE MOTOR STARTER

In many applications squirrel-cage motors cannot be switched direct on line and the methods at present used to give reduced voltage starting employ star-delta connection, primary resistance or auto-transformers. A starter of the primary resistance type but employing thermo-variable liquid resistances in place of fixed metallic resistances has recently been announced by Lee Guinness, Ltd., Newtownards, Northern Ireland. The company has secured the sole manufacturing and selling rights of this starter for the United Kingdom and the Commonwealth excluding Canada from the joint patent holders in France, M. Berard and the Association des Ouvriers Instruments Precision. The "Statormatic" starter gives greatly reduced current peaks during starting and can be simply calibrated to provide the correct torque for any drive while giving smooth and continuous motor acceleration.



A 25 h.p. "Statormatic" starter showing the two contactors and the electrolyte tanks

The complete starter consists of a triple-pole line contactor with thermal overload protection, three resistance units, one in each phase, and an associated triple-pole short circuiting contactor under time control to take the resistances out of the circuit. The action of the liquid resistance units is based on the reduction in the resistance of certain electrolytes when their temperature is raised. This reduction is in the ratio of some 5 : 1 over the temperature range employed in the apparatus during the starting cycle.

On starting, the short circuiting contactor is open and the resistances are inserted in the motor circuit giving a reduced voltage. The torque and current are limited to values predetermined by the calibration of the resistance. During the starting period the resistance inserted decreases with the rise of temperature of the liquid electrolyte in the thermal chamber due to the passage of the starting current. The voltage at the motor terminals increases to a maximum value of some 85 to 95 per cent of the line voltage at the end of the accelerating period, and the short circuiting contactor is closed by the timer. The current peak at the point of short circuiting is negligible.

The resistance element in each phase consists of two electrodes protected by insulating sleeves and immersed in a liquid electrolyte. These electrodes are exposed at their lower ends which enter a steatite "thermal chamber" of a predetermined volume. By removing part of the insulating sleeve, it is possible to vary the area of the electrode utilised and consequently the value of the initial liquid resistance. The volume of the thermal chamber is also selected as a function of the h.p. of the motor and the torque which it is required to develop.

The whole assembly is contained in a reinforced polythene tank of either two or five litres capacity, and orifices of predetermined size in the sides of the chamber allow free passage of liquid between the thermal chamber and the mass of the electrolyte in the tank. After completion of the starting cycle the electrolyte in the chamber reaches the same temperature as the mass of liquid in the tank in one or two seconds. The checking of the electrolyte level is only infrequently required and the tanks can be topped up with water if necessary.

Six sizes of starter are available for motors up to 100 h.p. and the prices range from £68 to £202 according to the voltage and duty.

EMPLOYERS' LIABILITY

The Scope of Insurance Policies

By F. E. SUGDEN

AN action which recently occupied the attention of the Court of Appeal is of interest to electrical contractors and others who insure their employees. In this case an employer had taken out a policy under a personal accident group scheme with an insurance company. The policy provided that if any insured person should sustain bodily injury resulting in death the insurance company would pay the sum insured, set out in a schedule to the policy. It was a condition of the policy that "the insurance company shall be entitled to treat the insured as the absolute owner of this policy . . . and the receipt of the insured or the insured's legal representative alone shall be an effectual discharge." The employer paid the premium on the policy and the employee was insured for £1,000 in the event of bodily injury and death.

The existence of the policy was known to the employee and also other employees of the firm, so that they had a reasonable expectation of benefit for their dependants if they were killed, but they were not in a contractual position in law because they made no contribution towards the premium.

Agreed Damages

As a result of a fire at the employer's premises both the employer and the employee, whose dependants claimed against the estate of the employer, died. The employee's mother as administratrix of his estate brought an action under the Fatal Accidents Acts, 1846 to 1908, and the Law Reform (Miscellaneous Provisions) Act, 1934, claiming damages against the personal representative of the deceased employer alleging that the employer's negligence caused the fire. Liability was admitted by the deceased employer's personal representative and damages were agreed at £1,300.

The insurance company paid to the deceased employer's representative in respect of the employee's death £1,000 under the policy. The employer's personal representative had paid or had decided to pay this sum to the employee's mother. The question arose whether this sum should be deducted from the agreed damages as being a benefit arising on the death of this particular employee or was not so deductible by virtue of Section 1 of the Fatal Accidents (Damages) Act, 1908, whereby "any sum paid or payable on the death of the deceased under any contract of insurance" was not to be taken into account.

The Court of Appeal held that although neither the deceased employee nor his administratrix had any right at law to claim under the policy, yet the £1,000 was a sum paid or payable under a contract of assurance within Section 1 of the Fatal Accidents (Damages) Act, 1908, and was not deductible in assessing the damages recoverable for the deceased employee's estate for the following reasons:—

Section 1 of the Act of 1908 extended to payments of policy moneys contractually made to or on behalf of or for the benefit of the employees or dependants and was not limited to payments made directly to them. In this case the policy had been maintained by the deceased employer for the benefit of members of his staff and the £1,000 policy money paid by the deceased employer's personal representative to the employee's estate was within Section 1 though it was not paid in pursuance of enforceable right.

The case had been brought to the Court of Appeal because the personal representative of the deceased employer appealed against a decision of the High Court that the sum of £1,000 paid to the administratrix of the deceased employee in regard to her son's death should not be deducted from the damages payable by the deceased employer's personal representative in accordance with the Fatal Accidents Acts, 1846 to 1908, and the Law Reform (Miscellaneous Provisions) Act, 1934.

Section 1 of the Act of 1908 provides that "In assessing damages in any action, whether commenced before or after the passing of this Fatal Accidents Act of 1846 as amended by the Act of 1908 there shall not be taken into account any sum paid or payable on the death of the deceased under any contract of assurance or insurance whether made before or after passing of this Act."

In these circumstances the Court of Appeal upheld the decision of the High Court judge and dismissed the appeal.

The Court agreed with the High Court judge that the deceased employee's mother had in respect of the £1,000 no right that was enforceable in law as she was not a party to the policy. Nor did the terms of the policy themselves suffice to create a trust which she could enforce in a case like this where the insurance of the deceased employee was purely voluntary and was no part of his terms of employment.

This case is a warning to electrical contractors and other employers that they should scrutinise very carefully their policies of insurance in order to make sure that they are covered for all eventualities.

Medical Electronics

A MEETING of the Medical Electronics Discussion Group of the Institution of Electrical Engineers held recently was concerned with "Electronic and X-Ray Equipment for Explosive Atmospheres." It was pointed out that most explosive atmospheres occurring in hospitals consisted of oxygen-rich mixtures of flammable anæsthetic vapours. The properties of these mixtures differed from flammable vapour mixtures in industry, with air as the main component. The anæsthetist endeavoured to use non-flammable anæsthetics where a risk of ignition existed, but this was not always practicable.

The increasing use of electronic instruments in addition to traditional electro-medical and X-ray devices imposed further precaution. To avoid risk of anæsthetic explosion, such equipment for use within the operating theatre had to be either intrinsically incapable of producing ignition or be remotely operated in such a way that no components liable to cause ignition were situated within the area of hazard. Remote control of exposure factors by electronic circuits might in some cases be avoided by housing the entire equipment within a pressurised enclosure.

AUSTRALIA'S ELECTRICAL TRADE

DURING the Commonwealth's last financial year, ended on 30th June last, Australia's imports increased by £A1·7 million to £A37·2 million, while her exports decreased slightly from £A2·9 million to £A2·8 million. The United Kingdom's share in Australian imports decreased from 70 per cent to 65 per cent. Over the past three years Australian imports from the United Kingdom have decreased by 12 per cent, while imports from West Germany have increased by 78 per cent, and from the United States by 86 per cent. Whereas other foreign competitors supply the whole range of electrical goods, the Netherlands' competition is restricted to electronic products, and Japan's to cheap, mass-produced goods.

Electronic apparatus and wires and cables are the largest individual items among Australia's exports, and New Zealand is the most important market.

TABLE 1.—AUSTRALIAN ELECTRICAL TRADE (£000)

Country	1957–58	1956–57	1955–56	1954–55	1953–54
IMPORTS					
United Kingdom	24,470	24,944	27,808	22,649	20,448
France	169	182	188	130	143
West Germany	1,620	1,320	954	1,438	1,109
Italy	174	222	206	159	235
Japan	173	39	14	12	16
Holland	2,024	2,023	n.a.	n.a.	n.a.
Sweden	1,225	219	320	286	501
Switzerland	422	323	592	483	316
United States	6,085	4,766	3,252	1,998	1,501
EXPORTS					
United Kingdom	256	232	107	138	221
India	200	357	159	32	25
Malaya	87	44	147	115	79
Singapore	148	75	159	291	95
New Zealand	1,145	976	1,112	1,003	714
Papua	102	181	158	774	119

TABLE 2.—PRINCIPAL PRODUCTS IMPORTED

Product	Value (£A000)
Covered cable and covered wire, covered strip copper, metal sheathed, paper insulated (United Kingdom only)	168
Ditto, rubber insulated	9
United Kingdom	5
Ditto, plastic insulated	52
United Kingdom	45
United States	6
Ditto, wire insulated	400
United Kingdom	397
Ditto, enamelled, whether or not further covered with any other material	87
United Kingdom	66
United States	15
Ditto, plastic covered	51
United Kingdom	48
Ditto, otherwise covered	71
United Kingdom	47
United States	23
Induction voltage regulators, including the operating and control gear	260
United Kingdom	193
West Germany	30
Static transformers below 66 kV, up to and including 15 MVA	79
United Kingdom	46
Ditto, 66 kV, up to 4·5 MVA	32
Italy	15
Switzerland	9
Sweden	8
Ditto, 4·5 MVA, up to 15 MVA (Austria only)	63
Ditto, over 66 kV, up to and including 15 MVA	247
United Kingdom	182
Austria	37
Sweden	20
Ditto, 15 MVA to 30 MVA	320
United Kingdom	275
Austria	46
Ditto, above 30 MVA	653
United Kingdom	394
Belgium/Luxembourg	260
Parts of static transformers	139
United Kingdom	86
Belgium/Luxembourg	23
United States	13
Rectifiers and rectifier assemblies	570
United Kingdom	483
Holland	23
West Germany	17
United States	87
Vacuum tubes, n.e.s.	187
United Kingdom	137
United States	25
Holland	19
Outdoor circuit-breakers, 1 kV to 15 kV	103
United Kingdom	71
France	13
Italy	12
Ditto, 15 kV to 38·5 kV	59
United Kingdom	50
Ditto, exceeding 38·5 kV	415
United Kingdom	355
Switzerland	46
Switch units and circuit-breakers (other than outdoor), 1 to 38·5 kV	652
United Kingdom	629
Switch units and circuit-breakers, above 38·5 kV	23
United Kingdom	5
Switzerland	18
Ditto, up to 1 kV	146
United Kingdom	91
United States	48
Ditto, n.e.s.	985
United Kingdom	758
West Germany	78
Holland	34
United States	92
Regulating and distributing material including switch and distribution boards	2,523
United Kingdom	1,818
West Germany	151
Holland	28
United States	466
Fuses	358
United Kingdom	337
Lightning arrestors	163
United Kingdom	28
Sweden	124
Relays	331
United Kingdom	236
Batteries, accumulators and parts	328
United Kingdom	179
Lamps, filament	1,214
United Kingdom	671
Holland	275
Fluorescent tubes	338
United Kingdom	299
TV sets	183
United Kingdom	147
West Germany	33
Radio sets	231
United Kingdom	62
Denmark	25
Japan	94
Holland	30
Transmitters, radio	192
United Kingdom	148
United States	29
Parts of radio transmitters and receivers	1,350
United Kingdom	682
Denmark	66
Holland	64
United States	494
TV cameras	49
United Kingdom	16
United States	25
TV viewing tubes	1,905
United Kingdom	273
West Germany	162
Holland	250
United States	1,202
Radio valves	1,304
United Kingdom	639
Holland	388
United States	216
Parts of valves n.e.s.	365
United Kingdom	34
Holland	228
Telegraph instruments	227
United Kingdom	40
United States	167
Telephones and parts	1,532
United Kingdom	1,531
Telephone & telegraph appliances and parts n.e.s.	1,343
United Kingdom	1,089
West Germany	124
Hearing aids and parts	318
Cookers, ovens, grillers and boiling plates	381
United Kingdom	304
Other heating and cooking appliances	282
United Kingdom	178
United States	49
Holland	18
Flat irons	18
United Kingdom	18
Fans	181
United Kingdom	178
Dishwashing machines	29
New Zealand	28
Floor polishers, domestic	420
United Kingdom	299
Sweden	120
Vacuum cleaners, domestic	463
United Kingdom	461
Measuring and recording instruments	966
United Kingdom	654
Holland	189
United States	86
Generating sets, a.c., of 2 h.p. and over	126
United Kingdom	93
United States	23
Generating sets, d.c., of 1 h.p. and over	139
United Kingdom	88
United States	34
Generators, a.c., up to 125 h.p.	81
United Kingdom	75
Ditto, above 125 h.p.	2,404
United Kingdom	1,407
Sweden	948
Generators, d.c.	374
United Kingdom	62
United States	296
Motors, a.c., d.c. or universal, under ¼ h.p.	597
United Kingdom	528
United States	31
Ditto, a.c. induction type, ¼ h.p.	95
United Kingdom	82
Ditto, over ¼ h.p. up to ½ h.p.	74
United Kingdom	46
West Germany	17
Ditto, over ½ h.p. up to 1 h.p.	31
United Kingdom	20
West Germany	6
Motors, a.c., except induction type	9
United Kingdom	3
Parts of motors under 1 h.p.	149
United Kingdom	118
United States	23
Motors, a.c. induction, 1 to 5 h.p.	318
United Kingdom	201
West Germany	58
United States	22
Ditto, 5 to 10 h.p.	122
United Kingdom	81
West Germany	22
Ditto, 10 to 50 h.p.	230
United Kingdom	157
United States	36

(Continued at foot of next page)

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

34375. Metropolitan-Vickers Electrical Co., Ltd.—Velocity modulated electron beam devices operating with a pulsed power supply. 28th November, 1955. (824921.)

1955

8534. Automatic Telephone & Electric Co., Ltd.—Adding arrangements. 21st February, 1956. (824842.)

19076. English Electric Co., Ltd.—Arc welding. 28th September, 1956. (824928.)

19420. Permutit Co., Ltd.—Electrolytic cells. 21st June, 1956. (824929.)

26067. British Thomson-Houston Co., Ltd.—Glass-to-metal seals. 12th September, 1956. (824843.)

31278. Lacy-Hulbert, C.—Electric heating elements. 2nd November, 1955. (825049.)

32929. Gylling & Co. A.B.—Telephone sets for private telephone systems. 17th November, 1955. (825051.)

1956

989. Rank Cintel, Ltd.—Control circuits for cathode-ray tubes. 11th January, 1957. (825052.)

1301. Napier & Son, Ltd., D.—Electric commutators. 7th January, 1957. (825053.)

3199. Dubilier, W.—Manufacture of electrical capacitors. 1st February, 1956. (825128.)

3454. Licentia Patent-Verwaltungs-G.m.b.H.—Multi-phase convertor system. 3rd February, 1956. (Addition to 822021.) (825055.)

3477. General Electric Co.—Bearings. 3rd February, 1956. (825056.)

3707. Soc. d'Application Générale d'Electro-Matériel Standard.—Regulated electric feed systems for supplying rectified current. 6th February, 1956. (825008.)

5881. Cunningham, W. C.—Electric space heaters. 25th February, 1957. (825214.)

6929. Schwab, B.—Control of electrically driven sewing machines. 5th March, 1956. (824939.)

8846. General Electric Co.—Dynamo-electric machines. 21st March, 1956. (825061.)

10462. Soc. Générale de Constructions Electriques et Mecaniques Alsthom.—Vacuum type electric circuit-breakers. 5th April, 1956. (825062.)

13000. General Electric Co.—Electron discharge devices. 27th April, 1956. (825217.)

13696. Consolidated Electrodynamics Corporation.—Furnaces. 3rd May, 1956. (825132.)

14399. Igranic Electric Co., Ltd.—Braking control systems for d.c. motors. 9th May, 1956. (824855.)

16471. Elektrophysikalische Anstalt B. Berghaus.—Method and device for the automatic control and supervision of the initial period and the performance of electric glow discharge processes. 28th May, 1956. (824947.)

19775. Omar, A. W.—Electromechanical warp control system for looms. 26th June, 1956. (825221.)

22007. Siemens-Schuckertwerke A.G.—Electrical current measuring apparatus. 16th July, 1956. (Addition to 759047 and 767542.) (825137.)

22633. Postmaster General.—Apparatus for laying submarine cables. 30th September, 1957. (825138.)

23603. Mullard Radio Valve Co., Ltd.—Printed circuits. 17th July, 1957. (825224.)

24486. Relf, V. K.—Electric water heating and hot water control apparatus. 10th August, 1956. (825013.)

27077. Telephone Manufacturing Co., Ltd.—Electric guard circuit. 26th August, 1957. (824957.)

29279. British Oxygen Co., Ltd.—Electric arc welding. 25th September, 1957. (825147.)

30009. Cullinane, A. J.—Electrical earthing systems. 30th September, 1957. (825014.)

31189. Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler.—Electric conductor. 12th October, 1956. (824861.)

33496. Standard Telephones & Cables, Ltd. (Laboratoire Centrale de Telecommunications S.A.).—Electric circuits incorporating magnetic materials having a rectangular hysteresis loop. 2nd November, 1956. (825077.)

33747. Plessey Co., Ltd.—A.c. induction motor non-wound rotors. 14th November, 1957. (824863.)

35040. Bulova Watch Co., Inc.—Electric timepieces. 16th November, 1956. (825233.)

35492. Texas Instruments, Inc.—Semiconductor unit and method of making same. 20th November, 1956. (824864.)

36931. British Thomson-Houston Co., Ltd.—Arc furnaces. 2nd December, 1957. (825234.)

37042. Sperry Rand Corporation.—Switching device. 4th December, 1956. (824968.)

37043. Parsons & Co., Ltd., C. A.—Nuclear reactors. 22nd November, 1957. (825078.)

1957

609. Sturr, M. T.—Electric cookers for sausages, such as frankfurters. 7th January, 1957. (825082.)

2094. National Research Development Corporation.—Transistor amplifiers. 21st January, 1958. (825086.)

3113. Jersey Production Research Co.—Electric pulse modulation system. 29th January, 1957. (824976.)

3573. Research-Cottrell, Inc.—Systems for electromagnetically rapping electrodes of an electrostatic precipitator. 1st February, 1957. (825088.)

3761. Pulvari, C. F.—Electrostatic recording and reproducing apparatus. 20th September, 1955. (Divided out of 816109.) (824973.)

38859. Collins Radio Co.—Transistor phase detector. 13th December, 1957. (824754.)

40221. Isvenska Ackumulator Aktiebolaget Jungner.—Electric batteries. 27th December, 1957. (824524.)

40469. Advanced Research Associates, Inc.—Transistor amplifiers. 31st December, 1957. (824525.)

5006. Oxley, R. F.—Variable capacity fluid dielectric condensers. 3rd February, 1958. (825162.)

5908. General Electric Co., Ltd.—Glass compositions and glass-to-metal seals. 3rd February, 1958. (824872.)

6023. Marconi's Wireless Telegraph Co., Ltd.—Voltage regulating circuit arrangements. 7th November, 1957. (825091.)

6766. Landis & Gyr A.G.—Photoelectric scanning head for use in testing and calibrating meters such as electricity meters having a rotating measuring member. 28th February, 1957. (824980.)

7265. Westinghouse Electric Corporation.—Electrical apparatus and insulating materials therefor. 5th March, 1957. (825166.)

8908. Controlled Heat & Air, Ltd., and Metalectric Furnaces, Ltd.—Arc melting furnaces. 17th March, 1958. (825239.)

9690. Anaconda Co.—Apparatus for producing sheet metal by electrodeposition. 25th March, 1957. (824989.)

10896. Beswick, D. G. E., Beswick, K. E., and Melbourn, W. F.—Electric cartridge fuses. 3rd April, 1958. (824877.)

12014. Soc. Gram-Electric.—Electrical equipment for connecting a polyphase machine with a polyphase network. 12th April, 1957. (825240.)

12386. Admiral Corporation.—Burst synchronised oscillator circuits. 16th April, 1957. (824996.)

12852. Automatic Telephone & Electric Co., Ltd.—Automatic selecting switches. 21st February, 1958. (825177.)

12933. Machlett Laboratories, Inc.—Means and method of controlling high voltage electrical circuits. 23rd April, 1957. (824998.)

13626. Giardino, L., and Faenza, V.—Electromechanical measuring devices. 29th April, 1957. (825179.)

13863. Light & Power Accessories Co., Ltd., and Lott, F. J.—Clamping gland for armoured electric cables. 28th August, 1957. (825020.)

14134. Mole-Richardson (England), Ltd.—Lampholders or carriers for incandescent electric lamps of large power. 13th February, 1958. (825307.)

[Continued on next page

AUSTRALIA'S ELECTRICAL TRADE

TABLE 2—*continued*

Product	Value (£A000)
Motors, 50 to 150 h.p.	240
United Kingdom	197
West Germany	19
Ditto, 150 h.p. and over	565
United Kingdom	474
Motors, a.c., except induction type, 1 to 500 h.p.	89
United Kingdom	68
West Germany	11
Ditto, 500 h.p. and over	72
United Kingdom	56
Sweden	13
Traction motors	457
United Kingdom	227
United States	230
Parts of motors, 1 h.p. and over	444
United Kingdom	337
West Germany	21
United States	80
Convertors, rotary	22
United Kingdom	11
United States	8
West Germany	5
Steam turbines	173
United Kingdom	153
Switzerland	15
Steam turbine parts	1,762
United Kingdom	700

TABLE 3.—AUSTRALIAN EXPORTS

Product	Value (£A000)	
	1958	1957
Cables, wires and flex	257	405
Transformers and rectifiers, not rotary	60	85
Regulating, starting and controlling apparatus n.e.s. incl. switches and switchgear	213	197
Protective equipment	44	51
Miscellaneous fitting and wiring devices	123	112
Batteries and accumulators	213	164
Wireless transmitting sets	135	384
Ditto, parts, excluding valves	480	445
Telephones and telegraph instruments and appliances	227	174
Generators	218	154
Motors	67	65

NEW PATENTS *(continued)*

14377. Aladdin Industries, Inc.—Magnetically enclosed coil. 6th May, 1957. (825491.)

17783. Sylvania Electric Products, Inc.—Colour television receiver. 4th June, 1957. (825665.)

18180 Telefunken G.m.b.H.—Manufacture of transistors and other semiconductor devices. 7th June, 1957. (825494.)

18840. British Thomson-Houston Co., Ltd.—Rolling mills. 27th May, 1958. (824881.)

19022. British Thomson-Houston Co., Ltd. — Stator cores of dynamo-electric machines. 14th May, 1958. (824882.)

19146. National Research Development Corporation.—Electrical pulse circuits. 5th June, 1958. (825244.)

22903. General Motors Corporation.—Printed electric circuits. 19th July, 1957. (825495.)

22968. British Thomson-Houston Co., Ltd.—Luminescent materials. 18th July, 1958. (824886.)

24163. Aladdin Industries, Inc.—Wide-band tuning device for high-frequency oscillations. 30th July, 1957. (Addition to 771088.) (825497.)

25264. Standard Telephones & Cables, Ltd.—Electric phase equalising networks. 9th August, 1957. (825191.)

28196. General Electric Co., Ltd.—Colour television receivers. 26th August, 1958. (824889.)

28258. Hughes Aircraft Co.—Semiconductor device and method of making same. 6th September, 1957. (825674.)

28449. Siemens & Halske A.G.—Electromagnetic relay sets arranged in strip form. 9th September, 1957. (825589.)

29448. General Electric Co., Ltd., and Gallant, G.—Apparatus for vibrating electrical components. 15th September, 1958. (825195.)

31520. Eaton Manufacturing Co.—Eddy current clutches, couplings, brakes and dynamometers. 9th October, 1957. (824891.)

31819. General Electric Co.—Magnetic amplifiers. 11th October, 1957. (825688.)

34016. English Electric Valve Co., Ltd.—Manufacture of grid and mesh electrodes. 29th July, 1958. (825028.)

34429. Badische Anilin- & Soda-Fabrik A.G.—Production of ferrites. 5th November, 1957. (825251.)

36464. English Electric Valve Co., Ltd.—Klystron oscillator tubes. 14th August, 1958. (825383.)

39336. Columbia-Southern Chemical Corporation.—Electrolytic cells. 18th December, 1957. (825261.)

39511. Escher Wyss A.G.—Thermal power plants. 19th December, 1957. (824895.)

1958

1338. Compagnie Générale de Télégraphie sans Fil.—Circuit printing devices. 14th January, 1958. (825326.)

1986. Westinghouse Electric Corporation.—Electric circuit interruptors. 21st January, 1958. (824896.)

2961. Landis & Gyr A.G.—Thermostatic regulator valves. 29th January, 1958. (825269.)

3857. Stoll, G. (trading as Festo-Maschinenfabrik G. Stoll).—Single-phase motor. 6th February, 1958. (824898.)

3957. Mond Nickel Co., Ltd.—Electrodeposition of nickel. 6th February, 1958. (825031.)

8623. American Cast Iron Pipe Co.—Electrically-conductive spigot-and-socket joints for pipes, couplings and fittings and gaskets therefor. 18th March, 1958. (824833.)

9873. Philips Electrical Industries, Ltd.—Methods of producing electrodes for electrolytic capacitors. 27th March, 1958. (824901.)

9875. Philips Electrical Industries, Ltd.—Magnetrons having waveguide outputs. 27th March, 1958. (825341.)

10567. General Electric Co.—Cathodes and emissive material therefor. 2nd April, 1958. (824902.)

10859. Philips Electrical Industries, Ltd.—Electron microscopes. 3rd April, 1958. (824903.)

11514/5. Standard Telephones & Cables, Ltd.—Character recognition equipment. 11th April, 1958. (825597/8.)

13167. Belling & Lee, Ltd.—Electrical fuses. 25th April, 1958. (824905.)

13645. Engelhard Industries, Inc.—Operating circuit for electrical discharge lamps. 29th April, 1958. (824906.)

17349. Philips Electrical Industries, Ltd.—Devices for producing square-wave control voltages. 30th May, 1958. (825600.)

20208. Western Electric Co., Inc.—Electronic switching circuits. 24th June, 1958. (825038.)

21502. Escher Wyss A.G.—Multi-stage push-type centrifuges. 4th July, 1958. (825479.)

22852. Mullard, Ltd.—Cold cathode tubes. 16th July, 1958. (825360.)

26170. Philips Electrical Industries, Ltd.—Electric lead-through capacitors. 14th August, 1958. (825400.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated:—

18th December

Nulesco. No. 787,108. Class 7. Boilers, installations for feeding boilers, and condensers; heat exchangers (being parts of machines), steam engines (other than locomotives), and superheaters; machine tools and machines for cutting and grinding.—Superheater Co., Ltd., 97, Tottenham Court Road, London, W.1.

Milady. No. 790,390. Class 7. Drying machines; electrical machines for domestic purposes.—H. Morris, 186, Greengate, Salford, 3.

Pathé (design). No. B776,748. Class 9. Apparatus for transmission and reception of radio telegraphy and radio telephony; radio telephotographic apparatus; television receiving apparatus; gramophone records.—Les Industries Musicales et Electriques Pathé Marconi Société Anonyme, Paris, France. Address for service, c/o Reddie & Grose, 6, Bream's Buildings, London, E.C.4.

Gint. No. 789,261. Class 9. Radio and television apparatus, radiogramophones, loudspeakers, microphones, relays, thermionic valve and transistor amplifiers, switches, etc.—Grundig (Gt. Britain), Ltd., 39-41, New Oxford Street, London, W.C.1.

Thermocoax. No. 790,410. Class 9. Electrical conductors and thermocouples.—Société Anonyme d'Etudes et Realisations Nucleaires Sodern, Paris, France. Address for service, c/o T. D. Threadgold, Century House, Shaftesbury Avenue, London, W.C.2.

Nevibar. No. 792,010. Class 9. Electrical apparatus.—Lancashire Dynamo Nevelin, Ltd., Hurst Green, Oxted, Surrey.

Baby Gripper. No. B750,076. **Cadet Gripper.** No. B750,077. **Shatterproof Gripper.** No. B750,078. **Standard Gripper.** No. B750,079. **Wellglass Gripper.** No. B750,081. Class 11. Electric handlamps.—British Central Electrical Co., Ltd., 6 and 8, Rosebery Avenue, London, E.C.1.

Stella. No. 788,388. Class 11. Electric lamps for photographic lighting purposes.—Stella Lamp Co., Ltd., 158-160, Shaftesbury Avenue, London, W.C.2.

25th December

Vineta. No. 791,049. Class 7. Electrical washing machines and centrifugal drying machines.—R. S. Stokvis & Zonen N.V., Rotterdam, Holland. Address for service, c/o Stanley, Popplewell, Francis & Ross, Cursitor House, 9-11, Cursitor Street, Chancery Lane, London, W.C.2.

Luma. No. 786,584. Class 9. Radio, television and sound recording and sound reproduction apparatus and instruments.—Kooperativa Förbundet Ekonomisk Forening, Stockholm, Sweden. Address for service, c/o T. B. Browne, Ltd., 117, Piccadilly, London, W.1.

Framez. No. 788,726. Class 9. Electrical, electronic, radio, television, cinematographic, and sound measuring, recording and reproducing apparatus and instruments, etc.—Jennings Musical Industries, Ltd., Unity House, Dartford Road, Dartford, Kent.

Regnplug. No. 789,245. Class 9. Electric plugs incorporating devices for controlling the flow of electric current.—Sunvic Controls, Ltd., Crown House, Aldwych, London, W.C.2.

Tecalemit (design). No. 790,218. Class 9. Electrical apparatus for automatically operating solenoid valves at predetermined time intervals.—Tecalemit, Ltd., Plymouth.

Heliax. No. 792,853. Class 9. Coaxial cable.—Andrew Corporation, Chicago, Ill., U.S.A. Address for service, c/o F. J. Cleveland, 302-306, Bank Chambers, 329, High Holborn, London, W.C.1.

BA (design). Nos. 793,492-4. Class 9. Busbars.—British Aluminium Co., Ltd., Norfolk House, St. James's Square, London, S.W.1.

Fluxomatic. No. 793,363. Class 9. Electric current rectifiers for the automatic control of current and voltage.—Partridge Wilson & Co., Ltd., Davenset Works, Evington Valley Road, Leicester.

Super Gripper. No. B750,080. Class 11. Electric handlamps.—British Central Electrical Co., Ltd., 6 and 8, Rosebery Avenue, London, E.C.1.

Filtra. No. 791,191. Class 11. Electrically heated or gas heated containers made of ceramics, glass, porcelain or of pottery, for use in keeping liquids hot.—W. H. Bentz, trading as Melitta-Werke Bentz & Sohn, Minden, Westphalia, Germany. Address for service, c/o W. H. Beck, Greener & Co., 7, Stone Buildings, Lincoln's Inn, London, W.C.2.

Ekco. No. 793,159. Class 11. Refrigerators.—E. K. Cole, Ltd., Ekco Works, Priory Crescent, Southend-on-Sea.

Desmo. No. 792,819. Class 11. Electrical appliances and apparatus.—Desmo, Ltd., Pensnett Trading Estate, Pensnett, Brierley Hill, Staffs.

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 14th DECEMBER

Birmingham.—Grand Hotel, 6.15 p.m. Birmingham Electric Club. "Meeting the Computing Needs of the Small Organisation," by C. M. Berners-Lee.

Brigg.—Angel Hotel, 6.45 p.m. I.E.E. Sheffield Sub-Centre Discussion on "Planning and Development of Factory and Public Supply Electrical Systems."

Cardiff.—Reardon Smith Hall, 6 p.m. I.E.E. Western Centre. "The Provision of Adequate Electrical Installations in Buildings." "Multi-Storey Flats and Maisonnettes," by C. A. Belcher; "Small Industrial Premises," by J. A. Sharp. (Joint meeting with the Supply and Utilisation Groups.)

Chester.—Town Hall, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Generator/Motor Problems in Pumped Storage Installations," by J. H. Walker.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. informal meeting. Discussion on "Why Hi-Fi?", opened by P. P. Eckersley.

White Hall Hotel, Bloomsbury Square, W.C.1, 7.15 p.m. A.S.E.E. Central London Branch. "Electrical Development within the Port of London," by H. M. Harrison.

Newcastle-on-Tyne.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Centre. Diamond Jubilee Lecture, by J. R. Beard.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.S. Sheffield Centre. Technical film show.

Wembley.—Century Hotel, 8.15 p.m. A.S.E.E. North West London Branch. "Acrylic Plastics in Lighting," by J. B. Clark.

TUESDAY, 15th DECEMBER

Edinburgh.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. Symposium on "Electrical Installations." "Multi-Storey Flats and Maisonnettes," by C. A. Belcher; "Small Industrial Premises," by J. A. Sharp.

Farnborough.—Technical College, 6 p.m. I.E.E. Southern Centre. "Subscriber Trunk Dialling," by D. A. Barron.

Leeds.—The University, 6.30 p.m. I.E.E. North Midland Centre. "Investigations of Power Follow-Current Phenomena using a Synthetic Power Source," by Dr. L. L. Alston and Prof. F. M. Bruce. "The Impulse Initiation of Arc Discharges," by Dr. L. L. Alston.

Liverpool.—Merseyside and North Wales Electricity Board Industrial Development Centre, 6 p.m. I.E.S. Liverpool Centre. "New Development in the Calculation of Coefficients of Utilisation," by W. Robinson.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. Discussion on "Data Handling Problems in Atomic Installations," opened by Dr. D. Taylor.

At the Royal Institution, 21, Albemarle Street, W.1, 6.30 p.m. Association of Supervising Electrical Engineers. "Impressions of the Antipodes," by Lord Citrine.

Memorial Building, 76, Mark Lane, E.C.3, 5.30 p.m. Institute of Marine Engineers, Joint Nuclear Marine Propulsion Panel. "Some Aspects of Marine Reactor Safety," by K. Maddocks.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 3 p.m. and 6 p.m. British Institution of Radio Engineers. Symposium on "Magnetic Recording Techniques."

47, Belgrave Square, S.W.1, 5.30 p.m. Institute of Physics, Electronics Group. "Tubes for Colour Television," by K. G. Freeman.

Manchester.—Engineers' Club, Albert Square, 2.30 p.m. Combustion Engineering Association, North Western Region. "Heat Insulation," by Martin Edge and R. A. Mansergh.

Oxford.—Employment Exchange, 8 p.m. A.S.E.E. Oxford and Districts Branch. "Planned Maintenance," by F. Galloway.

WEDNESDAY, 16th DECEMBER

Glasgow.—39, Elmbank Crescent, 6 p.m. I.E.E. South-West Scotland Sub-Centre. Symposium on "Electrical Installations." "Multi-Storey Flats and Maisonnettes," by C. A. Belcher; "Small Industrial Premises," by J. A. Sharp.

Leeds.—St. Mark's House, 186, Woodside Lane, 7.15 p.m. Plastics Institute, Yorkshire Section. "Electrical Heating for the Plastics Industry," by Dr. A. Westerman.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "The Laying of Submarine Cables," by Captain W. H. Leech.

Manson House, 26, Portland Place, W.1, 7 p.m. Society of Instrument Technology. "Random Inputs and Load Variations," by J. F. Coales.

Nottingham. — E.M.E.B. Showrooms Theatre, Carrington Street, 7.30 p.m. A.S.E.E. Nottingham Branch. Films evening.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "Research on the Performance of High-Voltage Insulators in Polluted Atmospheres," by Dr. J. S. Forrest, P. J. Lambeth and D. F. Oakeshott.

Swansea.—Central Library, 7 p.m. Institution of Production Engineers, Wales Region. "Lighting and Colour as an Aid to Production," by R. Davies.

Wolverhampton.—Chamber of Commerce, District Bank Chambers, Lichfield Street, 7.45 p.m. A.S.E.E. Wolverhampton and District Branch. Open forum.

THURSDAY, 17th DECEMBER

Blackburn.—Castle Hotel, 7.30 p.m. Institution of Plant Engineers, Blackburn Branch. "Procedure to Avoid Disputes in the Engineering Industry," by J. B. Norton.

Bristol.—School of Management Studies, Unity Street, 7 p.m. British Institution of Radio Engineers, South Western Section. "The Transistor and its Use in Communication and Control Equipment," by E. Wolfendale.

Chester.—Grosvenor Museum, 7 p.m. Society of Instrument Technology, Chester Section. "Cost Control in Instrument Engineering," by S. Sheridan and J. Reed.

Croydon.—Greyhound Hotel, High Street, 8 p.m. A.S.E.E. South London Branch. "Electronics in Industry," by S. R. Rose.

Exeter.—Electricity Showrooms, Bedford Street, 3 p.m. I.E.E. South Western Sub-Centre. "Turbo-Generator Performance under Exceptional Operating Conditions," by T. H. Mason, Dr. P. D. Aylett and F. H. Birch.

Glasgow.—39, Elmbank Crescent, 7 p.m. British Institution of Radio Engineers, Scottish Section. "The Digital Voltmeter," by J. A. Irvine and D. A. Pucknell.

London.—Savoy Place, W.C.2, 6 p.m. I.E.E. Education Discussion Circle. Discussion on "The Presentation of the History and Philosophy of Science," opened by Prof. H. Dingle.

Memorial Building, 76, Mark Lane, E.C.3, 2.30 p.m. Diesel Engineers' and Users' Association. "Report on Heavy Oil Engine Working Costs and Performance, 1958/59," and an informal discussion on "Operating Problems"; "The Inventions of B.I.C.E.R.A.", by Dr. W. P. Mansfield.

Southampton.—Polygon Hotel, 7 p.m. I.E.E. Southern Centre. Annual dinner and dance.

FRIDAY, 18th DECEMBER

Edinburgh.—Department of Natural Philosophy, The University, Drummond Street, 7 p.m. British Institution of Radio Engineers, Scottish Section. "The Digital Voltmeter," by J. A. Irvine and D. A. Pucknell.

Leeds.—Parkway Hotel. A.S.E.E. Leeds Branch. Annual dinner-dance.

London.—Pepys House, 14, Rochester Row, S.W.1, 7 p.m. Junior Institution of Engineers. "Radioisotopes in Industry," by W. G. Busbridge.

SATURDAY, 19th DECEMBER

London.—Connaught Rooms, W.C.2, 6 for 6.30 p.m. Association of Supervising Electrical Engineers. Christmas gala and ladies' night.

Garcke's Manual

The latest edition of "Garcke's Manual of Electricity Supply" covering the period 1958-59 has recently been published by the Electrical Press, Ltd., 19-20, Noel Street, London, W.1, price £4. The constitution and functions of the Electricity Council are given in the general survey, with a statistical review of electricity supply progress, based on the various authorities' annual reports, and a section dealing with nuclear power development, giving details of the programme, the various power station design and construction groups and the United Kingdom Atomic Energy Authority. This is followed by a section dealing with the powers, duties and administration of the Central Electricity Generating Board, including regional and divisional organisation and the project engineering groups, with plant details and operating data of the Board's generating stations. Similar information is provided on the various Area Electricity Boards in England and Wales and the authorities in Scotland, Ireland, the Isle of Man and the Channel Isles.

The directory sections give particulars of the manufacturers of electrical and allied plant, and associations and institutions, while the Directory of Personnel includes principal senior officers of the Electricity Boards and the directors of electrical and allied manufacturing companies.

Business Efficiency Exhibitions

The Office Appliance and Business Equipment Trades Association has plans for organising two major displays next year. The first, the 47th National Business Efficiency Exhibition, will be held at Bingley Hall, Birmingham, from 16th to 21st May, and the second show will open at Olympia, London, on 3rd October.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Burma.—Burma Purchase Board, Rangoon. 14th December. Dry cells (62 gross) for hand torches. (E.S.B. 28288/59. Ten/43708.)*

Ceylon.—Ministry of Transport and Power, Colombo. 16th December. 85,000 electric lamps. (E.S.B. 27734/59. Ten/43623.)*

Dorset.—County Council. 4th January. Electric lamps. (See this issue.)

Egypt.—Purchases and Stores Department, Egyptian Railways, Cairo. 28th December. Electrical insulating materials. (E.S.B. 28107/59. Ten/43687.)*

Fareham.—U.D.C. 18th December. Trunk road lighting equipment. (See this issue.)

Faversham.—Corporation. 18th January. Group "A" street lighting equipment. (See this issue.)

Greece.—Ministry of Finance, State Procurements Service, Athens. 16th December. Insulation tapes and sleeving. (E.S.B. 28360/59. Ten/43709.)* 17th December. Radio transmitting and receiving sets. (E.S.B. 28358/59. Ten/43707.)*

India.—India Store Department. 11th January. Furnace for heat treatment of light alloys. (See this issue.)

Purchasing Officer, Sindri Fertilizers & Chemicals, Private, Ltd., Bihar. 4th January. Shunt limit switches for conveyors. (E.S.B. 28322/59. Ten/43715.)*

India Supply Mission. 17th February. One 30,000 kW steam turbo-generator, feed heating and ancillary plant for Amar Kantak power station. (E.S.B. 28042/59/I.C.A. Ten/43683.)*

Iran.—Directorate of Military Transmission Office, Teheran. 16th January. 7,750 radio valves. (E.S.B. 27977/59. Ten/43645.)*

Iraq.—Director of Contracts and Purchases, Ministry of Defence, Baghdad. 30th December. 2,500 12 V, 75 Ah portable secondary batteries. (E.S.B. 28392/59. Ten/43729.)*

Irish Republic.—Radio Eireann, Dublin. 12th January. Diesel alternator set. (E.S.B. 28058/59. Ten/43634.)*

Italy.—Ministero Difesa Aeronautica-Inspettorato Telecommunicazioni ed A.V., Rome. 30th January. Telephone insulators. (G.D. 6723/59. Ten/43753/4.)*

Mere.—Parish Council. 9th January. Trunk road "A" lighting equipment. (See this issue.)

Nigeria.—Federal Ministry of Works and Surveys, Ijora. 1st January. Supply of ceiling fans for two years from 1st April next. (E.S.B. 28444/59. Ten/43724.)*

Pakistan.—West Pakistan Water and Power Development Authority, Power Development Branch, Lahore. 31st December. 5 MVA, 66/33/11 kV transformers for Sargodha grid station. (E.S.B. 28173/59/I.C.A. Ten/43666.)* Power cables and accessories for the West Pakistan grid. (E.S.B. 28172/59/I.C.A. Ten/43669.)*

Directorate-General, Posts and Telegraphs, Karachi. 28th December. Power plant equipment for telephone system. (E.S.B. 28435/59/I.C.A. Ten/43719.)*

Salford.—Corporation. 5th January. Materials, including conduits and fittings, for the year ending 31st March, 1961. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

South Africa.—Durban Electricity Department. 29th January. Two 5 MVA throughput transformer voltage regulators. (E.S.B. 28059/59. Ten/43633.)*

Union Tender Board, Pretoria. 21st December. Intercommunication equipment. (E.S.B. 27907/59. Ten/43627.)* 30th December. 10 kW diesel electric generating plant. (E.S.B. 28294/59. Ten/43697.)* 7th January. Telegraph cable. (E.S.B. 27967/59. Ten/43621.)*

Sudan.—Central Electricity and Water Administration, Khartoum. 21st December. Electrical insulators and pins. (E.S.B. 28347/59. Ten/43710.)*

ORDERS PLACED

Honiton.—Corporation. Electrical wiring work in 40 houses, Jerrard Crescent (£1,026). —E. Hansford & Son.

St. Albans.—City Council. Recommended. Electrical installation work for additional shops, flats and maisonnettes on the London Road estate (£1,127).—W. Marchant.

Stockport.—Corporation. Recommended. Electrical installations in 117 dwellings (£4,811).—Simmons Electrical Contracting Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Ashington.—Y.M.C.A. centre (£36,000); R. E. Coleman, Ltd., builders, Western Hill, Durham City.

Aylesbury.—Houses (132); G. Wimpey & Co., Ltd., Hammersmith Grove, London, W.6.

Barking.—Reconstruction of Barking Station (£311,000) for British Railways (Eastern Region); Charles R. Price, building engineering contractors, Kingsbury Road, N.W.9.

Basingstoke.—Eight industrial buildings, Winchester Road; Percy Bilton, Ltd., builders, 52, Uxbridge Road, London, W.5.

Bath.—Flats and maisonnettes (117), with eight shops, Kingsmead; J. Wilkinson, planning officer, 7, North Parade Buildings.

Bristol.—Additional buildings for St. Brendan's College, Brislington; John Laing & Son, Ltd., Clifton Villas.

Cambridge.—New headquarters for County Fire Brigade, Parkside (four-year scheme to cost £200,000); county architect, Shire Hall, Castle Hill, Cambridge.

Cheltenham. — Three-storey extension; Dowty Equipment, Ltd., Hatherley Lane.

Colindale.—Office block, Colindale Avenue; H. H. Clark, architect, 3, Clement's Inn, London, W.C.2.

Dundalk (Co. Louth).—Factory (£100,000); John Halliday & Sons, Ltd., Quay Street.

Durham.—Extensions to St. Bede's and St. Hilda's Women's Colleges for Durham University (£225,000); Cordingley & McIntyre, architects, Owengate, Durham City.

New modern schools at Egglescliffe, Peterlee, Whickham, and High Usworth, and grammar technical school at Peterlee; county architect, South Street, Durham.

East Ham.—Boys' secondary school, Roman Road (£161,000); borough engineer, Town Hall, E.6.

Edinburgh.—Secondary school at Portobello (£500,000) and houses (188), St. Leonard's development area; A. Steele, city architect, City Chambers, High Street.

Gateshead.—Three blocks of 16-storey flats, Chandless redevelopment area (£696,152); Stanley Miller, Ltd., contractors, 17, North Street, Newcastle-on-Tyne.

Hartlepool.—Houses (193), and bungalows (28), King Oswy Drive; Taylor & Evans, builders, 22, Elwick Road, West Hartlepool.

Hendon.—Reconstruction of factory premises for Johnsons of Hendon, Ltd.; Elliott, Cox & Partners, architects, 172, Buckingham Palace Road, S.W.1.

Hull.—New general hospital, Anlaby Road (about £3,000,000); Yorke, Rosenberg & Mardall, architects, 2, Hyde Park Place, London, W.2.

Jarrow.—Factory for Sterling Foundry Specialities; R. Jordan, Ltd., builders, Back Queen Alexandra Road, North Shields.

Kidderminster.—Flats (127), Habberley estate; borough surveyor.

Leamington Spa.—Multi-storey block of flats, Rugby Road; Trepess, Harley-Smith & Steel, architects, 1, Church Street, Warwick.

London. — Multi-storey garage, service station, office block, etc., Upper Thames Street; Myton, Ltd., Western House, Western Avenue, W.5.

Store, High Street, Marylebone; F. W. Woolworth & Co., Ltd., Woolworth House, Marylebone Road, N.W.1.

Extensions of Polytechnic, Woolwich; Waterhouse & Ripley, architects, Staple Inn Buildings, W.C.1.

Church of St. Mary, Peckham; Robert Potter & Richard Hare, architects, De Vaux House, Salisbury.

Mansfield.—Factory, Southwell Road West; British Woodwares, Ltd., Stockwell Gate.

Mold.—School, Bryn Coch Lane; W. Griffiths, county architect, County Buildings, Mold.

Newcastle-on-Tyne.—Additions to the linear accelerator building at the General Hospital (£17,000); P. H. Knighton, chief architect, Newcastle Hospital Board, Benfield Road.

Applied science and mathematics building, Eldon Place, for King's College; Richard Sheppard, Robson & Partners, architects, 5, Southampton Place, London, W.C.1.

Northampton.—Factory, Dallington Fields; Supreme Furniture Works, Ltd., Junction Road, Kingsley.

Oswestry.—New police headquarters (£45,000); county architect, Column House, London Road, Shrewsbury.

Peterborough.—Houses (172), Crown estate; city engineer.

Rugby.—Two old people's homes (£110,000); county architect, Shire Hall, Warwick.

Salisbury.—Civic hall, Castle Street (£100,000); city surveyor, Council House, Bourne Hill.

Saltburn.—Houses (171), Marske; Laing Housing Co., Ltd., Lowther Road, Stanmore, Middlesex.

Stamford.—College of Further Education (£150,000); county architect, Sleaford, Lincs.

Stevenage.—Office block for Development Corporation; John Mowlem & Co., Ltd., 91, Ebury Bridge Road, London, S.W.1.

Taunton.—Extensions to teaching block, Queen's College; E. D. Mills & Partners, architects, Richmond Buildings, Dean Street, London, W.1.

Tipton.—Office block and canteen; British Castors, Ltd. Britannia Works.

Widnes.—Public baths; borough architect, Brendan House, Widnes Road.